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South Dakota

Duck and Pheasant Use of Water Bank Program Agreement Areas in East-Central South Dakota

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April 1985

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DUCK AND PHEASANT
USE OF WATER BANK PROGRAM
AGREEMENT AREAS IN
EAST-CENTRAL SOUTH DAKOTA

Abstract

A 4-year field trial in the prairie pothole region of east-central South Dakota evaluated wildlife use of 10 Water Bank Program (WBP) and 10 non-WBP study sites. Each WBP site was paired with a non-WBP site having comparable amounts of upland and wetland habitat. When this study was initiated, the WBP sites were in their first or second year of retirement from agricultural production. WBP lands were generally left in an undisturbed condition throughout the study period. On non-WBP sites, normal agricultural practices occurred.

From 1978 to 1981, data pertaining to duck, ring-necked pheasant (Phasianus colchicus), and other wildlife use were collected on the 20 study sites. Analysis of variance (AOV) procedures were employed to analyze use of those areas by wildlife. Little difference in duck pair and brood use of WBP relative to non-WBP sites was exhibited. Differential use by adult and young American coot (Fulica americana) was also not shown. Occurrence of pheasants was significantly greater on the WBP sites. As a whole, the number of other wildlife species observed per hour varied little between the WBP and non-WBP sites. However, differential use of the undisturbed and disturbed cover conditions present on the WBP and non-WBP sites was apparent for some species. Whitetail deer (Odocoileus virginianus) occurrence on WBP sites was nearly three times as great as on non-WBP sites.

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INTRODUCTION

The Water Bank Program (WBP) was initiated in 1972 primarily to preserve, restore, and improve wetlands in important migratory waterfowl nesting and breeding areas. The main area of concern was the prairie pothole region of the north central states. In the 14 states eligible for the program, 5,948 WBP agreements covering 665,064 acres (averaging 31 acres of wetland and 80 acres of adjacent upland habitat) were in effect as of September 30, 1982 (USDA-ASCS 1983). Approximately 72 percent of the agreements and total acreage were located in the Dakotas and Minnesota.

Under the Water Bank Program, the United States Department of Agriculture is authorized to offer 10-year agreements or contracts for protection and management of wetlands with annual payments to private landowners. The landowner agrees that wetlands will not be used in any way that destroys their character as breeding or nesting areas. Uplands withdrawn from agricultural production are included in the agreement area to provide habitat for nesting waterfowl and other wildlife. Where necessary, the uplands are seeded to grass or grass-legume cover.

The objective of this study was to determine wildlife use of WBP sites and to compare this use with that received by similar non-WBP sites.

STUDY AREA

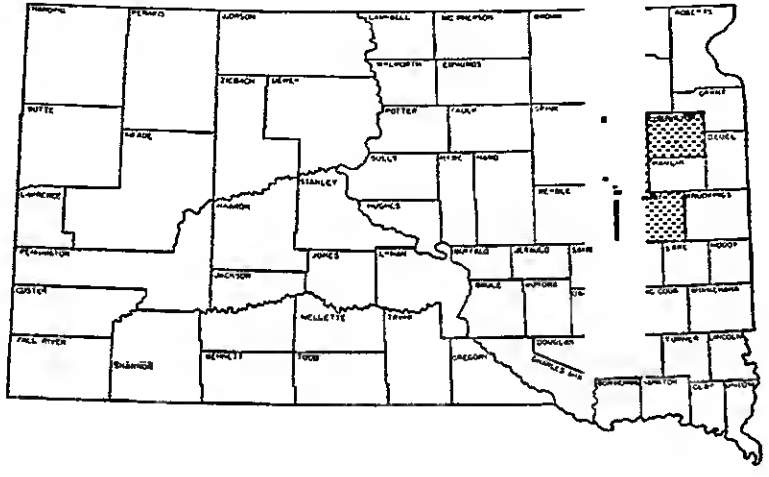
The study area was located on the Coteau des Prairie in east-central South Dakota between the James River lowlands to the west and the Minnesota River and Red River lowlands to the east. The Coteau is a massive highland area composed of silty and loamy glacial drift overlying marine shale bedrock (Flint 1955). Drainage is poorly developed and the area contains numerous prairie potholes.

Ten WBP sites were paired with 10 similar non-WBP sites. Nine of the 20 study sites were located in Clark County, eight in Kingsbury County, and three in Codington County (Figure 1). The study sites were within an area approximately 15 miles wide and 60 miles long. The distance between respective WBP and non-WBP components of the 10 paired study area sites averaged 4.2 miles and ranged from 1.0 to 6.2 miles. Size of the individual study sites ranged from 156 to 222 acres and averaged 172.3 and 162.1 acres, respectively, on the WBP and non-WBP sites. Acreages of Type 3 and Type 4 wetlands (Shaw and Fredine 1956) averaged 36.8 acres on the WBP sites and 38.7 acres on the non-WBP sites.

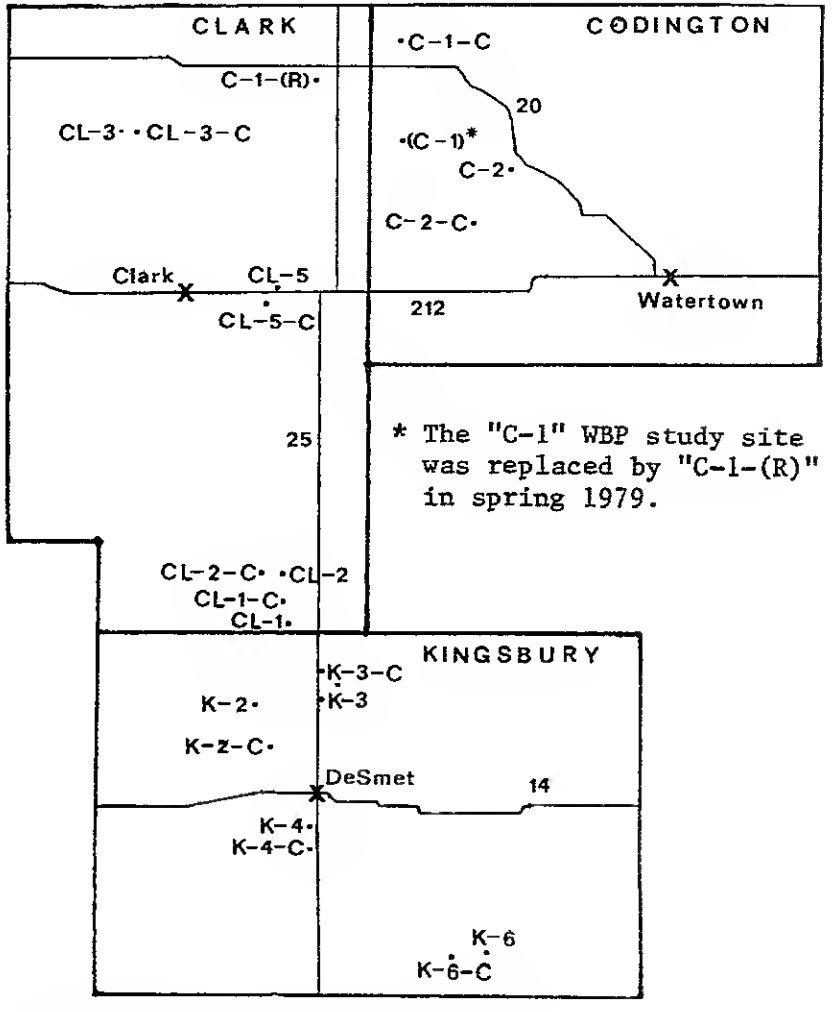
Agriculture was the primary land use along the perimeter of the 20 study sites (Appendix A). Wheat, oats, flax, corn, sunflowers, and beef and dsiry cattle were the major products. Croplsnd snd pasture were the principal uses on non-WBP sites, comprising 61 percent of their total acreage (Appendix B). Cover occurring on the WBP aites was classified into 13 cover-type designations (Appendix C). WBP sites ware under a nonagricultural use. In 1980 and 1981, the counties in which the study sites are located were given an "emergency drought status," and haying for livestock forage was permitted on WBP agreement areas. Three WBP study sites were hayed in 1980 and six were hayed in 1981. Haying occurred only on the uplands in 1980, but wetlands were also hayed on three WBP study sites in 1981.

Individual black and white aerial photo reproductions of the 20 study area sites and a legend to the information contained on the photos are supplied in Appendix D. These photos enumerate land uses on non-WBP sites, land uses adjacent to all 20 study sites, the cover types and conservation management practices applied on WBP sites, and other study area features. The photos were printed from Agricultural Stabilization and Conservation Service color trsnsparencies taken during the summers of 1980 and 1981.

1 inch = 96 miles



1 inch = 12.8 miles



The 3 county seats and major state highways are indicated.

Figure 1. Location of 10 paired study area sites in east-central South Dakota. WBP study sites are designated by a letter for county and are referenced by a number (e.g. "K-6"). The same letter/number combination is used for corresponding non-WBP sites but is followed by a "C" (e.g. "K-6-C").

METHODS

Ten WBP sites were selected in the spring of 1978. Each was paired with a non-WBP site having comparable amounts of upland and wetland habitat.

WBP agreement areas that entered the program in 1977 or 1978 were chosen, because nest cover establishment and conservation management practices had only recently been applied. Six of the 10 WBP study sites entered WBP in 1977, and four entered in 1978. The first year of the study provided "base line data" on the study sites. In subsequent years, changes in wildlife use were measured to determine relative trends in that use. One site was lost to the study at the start of the second year because the landowner sold the property to a person who did not wish to participate in the WBP. A replacement WBP study site was selected and wildlife count data for both sites were combined for use in final data analysis.

Counts of ducks, pheasants, and other wildlife were made at each of the 20 selected study sites during 1978-1981. Three duck pair counts were conducted on each site each year during 1978-1980 for a total of 180 counts. Counts were made during mid-April through late June or early July. Because of poor water conditions, only the first pair count was conducted in 1981 (April). There were 200 counts made over the 4-year period. Wetlands were censused using the walk/wade technique. To avoid duplicate counts, birds flushed were watched until they landed or left the study area site. All ducks observed were recorded by species and sex. Only certain components of a censused population were tabulated as "indicated" breeding pairs, based upon the criteria outlined in Hammond (1969). Adult American coots (Fulica americana) were counted during the duck breeding pair counts.

Two brood counts per site per year were used to census duck broods in 1978-1980 (119 counts). In 1981, no brood counts were conducted due to the lack of water. Brood counts were made from mid-June to early August. Wetlands containing water were searched by wading throughout the emergent vegetation. In dry years some study sites only had water in dugouts, and in these instances only the dugout area was searched. Broods were recorded by species, and the number of young were counted and aged through Class III, as detailed by Gallop and Marshall (1954). Broody hens that flushed and exhibited a "distraction display" indicated the presence of undetected broods (Hammond 1970). Number of broods observed was added to the number of broody hens to estimate the total number of broods. Young coots observed were recorded during duck brood counts.

· water depths were made each year while wading the
ng duck counts. In addition, during the initial
1979 a post was placed in a wetland on 17 of the
Absolute water depth measurements were made at

the post location to monitor relative trends in water conditions as the season progressed and between successive years.

Ring-necked pheasants (Phasianus colchicus) were counted during the duck pair counts and the brood counts made between 1978-1981 (319 counts). In addition, seven visits were made to study sites to collect data specifically on pheasant use. A pheasant brood count was made during August 1978 and during August 1979. Two pheasant crowing cock counts were conducted from mid-April through mid-June 1979 using the triangulation method described by Robertson (1958). Fall flushing counts of pheasants were made in 1979-1981 during the 2-week period preceding the opening of the pheasant hunting season in October. Numbers of pheasants observed during all counts were combined for use in data analysis.

Data on the occurrence of "other" wildlife were recorded during all census counts and included the number of bird and mammal species observed per site per visit. The number of individuals observed was also recorded for those species whose movements could readily be followed. During the 4-year period, 452 visits were made to the 20 study sites (see Appendix E). To identify small mammal species present, snap-trap surveys were conducted in June-August 1978 and June-July 1979.

Generally more time was spent in making counts on WBP study sites due to their slightly larger size and heavier cover conditions. An average of 2.0 hours was spent per visit on WBP sites and 1.6 hours on non-WBP sites. Because a greater amount of time was spent on WBP sites, the data on other wildlife are summarized as the number of species observed per hour of effort. Data on adult pheasants are expressed in terms of the number observed per hour.

To minimize biases due to weather conditions, the counts were conducted simultaneously or during the same hours on a later date, under similar weather conditions, on the WBP and non-WBP sites of each pair. Sixty percent of the counts made over the 4-year period were conducted using two observers.

The relative wildlife use of WBP compared to non-WBP sites was examined by analysis of variance (AOV) utilizing the Statistical Analysis System (SAS) package (SAS Institute, Inc. 1979). Tests of significant differences using AOV were conducted on the following wildlife data parameters: duck pairs; duck broods; adult coots; number of adult pheasants per hour; and number of other bird species per hour. Data obtained on the remaining wildlife parameters was not sufficient to make a statistical analysis meaningful.

Nests encountered during count activities were recorded in 1978-1980. During the summer of 1981, a nest search was conducted on each of the 10 WBP sites to determine use of the habitat on WBP sites by ground-nesting birds.

Restricted randomized transects were used to sample the occurrence of nesting. All upland and dry wetland habitat along the transect was searched. The width of cover searched along the transect line varied indirectly with the vegetation density. The amount of cover searched ranged from 2 to 5 percent of the individual acreages of the 10 WBP sites, for a total of 66.8 acres searched. Cover searched was categorized into one of 9 "cover types."

RESULTS

Water Conditions

Due to a heavy snowpack accumulated in the winter of 1977-1978, study site wetlands were filled to capacity and provided excellent conditions for breeding ducks in the spring of 1978. In previous years (approximately 1975-1977) portions of eastern South Dakota experienced drought conditions and heavy emergent cover had developed in wetland basins. High water levels in 1978 reduced the amount of emergent vegetation. From 1979 to 1981, drought conditions prevailed once again, and the amount of emergent vegetation increased as water conditions deteriorated. Eight non-WBP sites received moderately heavy grazing pressure in the wetlands during the study period. Consequently, non-WBP sites tended to have more exposed shoreline and did not become as choked with vegetation as did WBP wetlands which were in a non-use status.

Wetlands on four study sites were dry by late June to early July of 1979; three were WBP sites and one was non-WBP. When duck brood counts were conducted in 1980, wetlands on 12 sites had completely dried. Seven of these were WBP sites and five were non-WBP. During the April 1981 duck pair count, only seven sites (four WBP and three non-WBP) had water in the wetland or in channels or ditches within the basin. Of the remaining sites, only four WBP sites and seven non-WBP sites had water in the dugouts. Two WBP sites were completely dry in 1981 (Figure 2).

During April and May of 1979, the initial water depth at the posts ranged from 12 to 27 inches on WBP sites and from 4 to 24 inches on non-WBP sites. In April and May of 1980, 3 WBP and 5 non-WBP sites had no water at the posts, and on the remaining 9 sites the readings ranged from 5 to 22 inches on 5 WBP sites and from 6 to 12 inches on 4 non-WBP sites. In April 1981, 16 sites had readings of "0" inches, while 1 WBP site had a water level reading of 7 inches.

Duck Pairs

During 1978-1981, a total of 4,407 indicated breeding pairs was recorded on the 20 study sites (Table 1 and Appendix F). The number of pairs observed on WBP sites was four percent greater than on non-WBP sites; however, the difference was not significant. From 1978 to 1980, the number of pairs recorded decreased by 76 percent, with decreases of 83 percent on WBP and 69 percent on non-WBP sites.

Figure 2. Water depths of the various wetlands on the 20 WBP conservation field trial study sites, 1978 through 1981.

WBP Study Site	Date	Depth at post inches	General water depth estimates by wetland number	non-WBP Study Site	Date	Depth at post inches	General water depth estimates by wetland number
K-6	4-27-78		Max. 38-40", aver. 31"	K-6-C	7-10-78		Aver. 20"
	7-11-78		Aver. 20"				
	5-22-79	17	9-18", 24" in channels		5-21-79	none set	6-21"
	6-14-79	16			6-13-79		12-18", N. part 6"
	7- 3-79	15	9-15"		7- 2-79		12-15", 18" Max., N. part almost dry
	7-20-79	13	Aver. 6"		7-20-79		3-12"
	8- 1-79	12	9-21" in channels		8- 1-79		Aver. 8-10"
	5- 1-80	5	Max. 3-6" in scattered patches, 12-15" in channels		5- 1-80		Max. 3-4" in patches
	5-21-80	2	Max. 4", Aver.1-2"		5-21-80		Max. 2" but mostly dry
	6-12-80	9	Max. 10", aver. 2-4"(N.end) 5-7"(S.end)		6-12-80		Max. 10", aver. 6-8"
	7-17-80	0	Dry		7-17-80		Dry
	8- 6-80	0	Dry		8- 6-80		Dry
	4-13-81	7	1-4", small isolated patches max. 7-11" in channels, dugout full		4-14-81		Dry, dugout ¼ full
K-4	4-26-78		#1-aver. 20"	K-4-C	6-20-78		#1-aver. 25-26"
	7-12-78		#1-aver. 15";#2-aver. 9"		7-12-78		#1-aver. 20-22"/#2-aver. 22-24"
	5-21-79	none set	#1-max.3-6" but mostly dry;#2-nearly dry		5-22-79	11	#1—12-18";#2—9-21"
	6-13-79		All wetlands dry, water only in dugouts		6-14-79	8	#1—12-15";#2—12-18", 21" in channel
	7- 2-79		Same		7- 3-79	8	#1—12";#2—12-18"
	7-20-79		Same		7-20-79	5	#1—3-12";#2—3-18", 21" in channel
	8- 1-79		Same		8- 1-79	0	#1—9-15";#2—3-12"
	4-30-80		All wetlands dry, water only in dugouts		4-29-80	0	#1-dry;#2-only soggy
	5-22-80		Same		5-20-80	0	Both wetlands dry, water only in dugout
	6-11-80		Same		6-10-80	0	Dry except for 18" in channel of wetland #2 and dugout
	7-16-80		Same		7-15-80	0	Dry, water only in dugout
	8-16-80		Same		8- 5-80	0	Same
	4-14-81		Both wetlands dry; #1 dugout 2/3 full, #2 dugout 1/3 full		4-13-81	0	Both wetlands dry, dugout full
K-3	4-26-78		Max. 30"	K-3-C	—		
	6-22-78		22-24"		6-26-78		Aver. 20"
	7-17-78		Max. 20-24", aver. 17"		7-14-78		Max. 25-26", aver. 18"
	5-18-79	19	18-24"		5-17-79	12	6-24", aver. 18"
	6- 7-79	6	12-21"		6- 6-79	10	9-21"
	6-28-79	5	9-21", drainage channel dry		6-27-79	9	9-24", aver. 18" E.loop portion 6-15"
	7-19-79	0	6-15"		7-18-79	3	6-15", E. loop portion 3-6"
	7-31-79	0	6-12"		7-31-79	2	6-9"
	4-29-80	0	Max.5", aver. 3", drainage channel dry		4-29-80	0	6-18", E. loop portion dry
	5-20-80	0	Max.6", aver. 2-3"		5-20-80	0	Max. 3-6" in patches
	6-10-80	0	Max.6-7", aver. 3-4"		6-10-80	0	Max. 8-9", aver. 4-5"
	7-15-80	0	Max. 3", aver. 1"		7-15-80	0	Only soggy
	8- 5-80	0	Dry		8- 5-80	0	Dry
	4-15-81	0	Both wetland and dugout dry		4-15-81	0	Dry, dugout ½ full

Figure 2. (continued)

WBP Study Site	Date	Depth at post inches	General water depth estimates by wetland number	non-WBP Study Site	Date	Depth at post inches	General water depth estimates by wetland number
K-2	6-21-78		#4--3-4"	K-2-C	6-21-78		#2-max. 20"; #3-max. 4" in places, but mostly dry
	7-13-78		#1-aver. 22-24"; #3-aver. 15"; #4-dry		7-13-78		#1--3-4"; #2&#3 dry
	5-18-79	12	#3--6-9"; #2 & #4 dry		5-17-79	24	#1--2-4"
	6- 7-79	9	#3--3-5"		6- 6-79	22	All wetlands dry, water in the dugout
	6-27-79	7	#1-max. 12"; #3-only soggy		6-28-79	17	Same
	7-18-79	0	Water only in the dugout		7-19-79	5	Same
	7-31-79	0	Same		7-31-79	0	Same
	4-28-80	0	All wetlands dry, water in dugout		4-28-80	10	All wetlands dry, water in dugout
	5-19-80	0	Same		5-19-80	0	Same
	6- 9-80	0	Same		6- 9-80	0	Same
	7-11-80	0	Same		7-11-80	0	Same
	8- 7-80	0	Same		8- 7-80	0	Same
	4-16-81	0	All 4 wetlands dry, dugout 2/5 full		4-15-81	0	All 5 wetlands dry, dugout 2/5 full
CL-5	6-29-78		#1--22-24", aver.19";#2-similar to #1	CL-5-C	7- 5-78		Max. 15", aver. 8-10"
	7-24-78		#1--22-24", aver.15";#2-aver. 15"		7-25-78		Aver. 4-5" in places, but mostly dry
	5-14-79	12			5- 8-79	4	Max. 10", aver. 6-7"
	5-24-79	10	#1--6-14";#2--12-15"		5-31-79	3	6-12"
	6-21-79	11	#1--9-12";#2--12-18"		6-22-79	4	3-12"
	7-11-79	7	#1--3-9";#2--6-9"		7-12-79	0	3" max.
	7-23-79	4			7-23-79	0	
	4-15-80	5	#1-max. 9", aver. 3";#2-max. 9", aver. 3-6"		4-16-80	0	Max. 4-5" in patches
	5- 8-80	3	#1-max. 6", aver. 2";#2-max. 12", aver. 4"		5- 8-80	0	Only soggy
	6- 2-80	3	#1-max.4-5", aver. 2"patches;#2-max. 12", aver. 6"		6- 2-80	0	1-3" in places, much only soggy
	6-26-80	1	#1-max.3", aver. 1";#2-max. 6", aver.2-4"		6-26-80	0	Soggy, small scattered patches 1-2"
	7-22-80	0	#1 dry;#2--2-3" in places, but mostly soggy		7-22-80	0	Dry
	4-28-81	0	#1 dry;#2-patches 1-3", dugout full		4-29-81	0	Wetland dry, dugout full
CL-3	6-23-78		#1--22-24";#2--20-22";#3--19";#4--4"	CL-3-C	6-23-78		Aver. 30"
	7-20-78		#1--22-24"/#2--20"		7-20-78		Max. 40", aver. 25-26"
	4-26-79	17	#2--10";#3--7"		5- 2-79	14	Max. 36", aver. 24"
	5-31-79	14	#4-dry		5-29-79	12	15-24"
	6-25-79		#3-dry		6-26-79	10	15-24"
	7-16-79	11	#1--3-18";#2--3-5"		7-17-79	10	12-24"
	7-25-79	11	#1--6-15";#2--1-5"		7-26-79	12	12-33"(the 33" in channel)
	4-14-80	11	#1-18";#2--2" max. in patches		4-14-80	12	15-27", 48" max. in channel
	5- 7-80	7	#2--12-18";#2,#3 & #4-dry;#5--2" max.		5- 7-80	11	Max. 30", aver. 21"
	6- 3-80	4	All wetlands dry except #1		6- 3-80	6	12-24"
	6-23-80	4	#1-max. 15", aver. 6-9"		6-23-80	4	15-24"
	7-23-80	0	All wetlands dry, water in dugout		7-23-80	0	12-15" patches to dry or soggy in places, 24" max. in channel
	4-29-81	0	All wetlands dry, dugout ½ full		4-28-81	0	Patches in wetland 1-3", max. 4-5", channel dry, dugout full

Figure 2. (continued)

WBP Study Site	Date	Depth at post inches	General water depth estimates by wetland number	non-WBP Study Site	Date	Depth at post inches	General water depth estimates by wetland number
CL-2	6-28-78		#1--aver.3-4"22-24";#3 drain ditch-max. 15"	CL-2-C	6-28-78		#1-aver. 22-24";#2-aver.20";#3 dry
	7-19-78		#1-aver. 17"		7-19-78		#1-aver. 19";#2-aver. 16"
	5-15-79	18	#1-max. 27", aver. 21";#4--3-6"		5-16-79	16	#1--15-21;#2-max.24",aver.21";#3--7-8"
	6- 5-79	14			6- 1-79	12	#1--12-15";#2--15-21";#3--6-8"
	6-26-79	14	#1-max. 24", aver. 15-21";#2, #3 & #4-dry		6-25-79	11	#3-dry
	7-17-79	9	#1--9-18"		7-16-79	7	#1--9-21";#2--12-18"
	7-26-79	10	#1--max. 18", aver. 6-15"		7-25-79	-	#1--9-15";#2-9-15"
	4-24-80	0	#1-patches 3-6";#2&#4-dry;#3-soggy		4-24-80	0	#1-scattered patches 3-5";#2-max.3",mostly dry;#3 dry
	5-16-80	0	#1-mostly dry with patches 1-5", small area 3-12"		5-16-80	0	#1-only soggy;#2--dry except for two"ponds
	6-20-80	6	#1-max. 18", aver. 6-12", but patchy; #3--24"		6-20-80	6	#1-aver.8-12";#2--3-15", aver. 9";#3-max. 9:, aver. 3"
	7-10-80	2	#1--2-15", patchy;#3-soggy, other wetlands dry			7-10-80	5 #1-max.15", aver. 9";#2-max. 15", aver. 6-8";#3-dry
	7-31-80	0	#1-range dry to 9", aver. 3"		7-31-80	0	#1-aver. 3"S.of dugout;#2-up to 6" aver. 3"
	4-22-81	0	#1-small part with 1-2", dugout 3/4 full		4-21-81	0	All 3 wetlands dry, stockponds in #2 with 12-24", dugout 3/4 full
CL-1	6-27-78		#1-max.22-24"aver.15";#2--15"in trees; #3--15"	CL-1-C	6-27-78		#1-max. 36-38" aver. 30";#2-15"
	7-18-78		#1-max.23"aver.15";#2-aver.13";#3-aver. 15"		7-18-78		#1-max. 34-36", aver. 29";#2-max. 15"
	5-16-79	none	#1--6";#2-almost dry, max.3";#3-max. 9"		5-15-79	23	#1-32"
	6- 1-79	set	#1--6-12";#2-dry;#3-6"		6- 5-79	18	
	6-25-79		#2&#3-dry;3" in stockpond		6-26-79	17	#1-max.36", aver. 27-30";#2-max.12"
	7-16-79		All wetlands dry		7-17-79	13	#1-aver. 24-27";#2-nearly dry, max. 3"
	no count		same		7-26-79	13	
	4-23-80		All wetlands dry, 10" in stockpond		4-23-80	0	#1-max. 15", aver. 6", except for 21-24" in channels;#2 dry
	5-15-80		All wetlands dry, 4" in stockpond		5-15-80	0	#1-max. 15", aver. 9-12"
	6-19-80		Stockpond and all wetlands dry		6-19-80	0	#1-aver. 10-12", max. 21" in channel
	7- 2-80		same		7- 2-80	0	#1-max. 18", aver. 9-12", 9-24"in channels
	7-30-80		same		7-30-80	0	#1-max. 6" in channels
	4-21-81		All wetlands and stockpond dry		4-22-81	0	Both wetlands dry, dugout ½ full

Figure 2. (continued)

WBP Study Site	Date	Depth at post inches	General water depth estimates by wetland number	non-WBP Study Site	Date	Depth at post inches	General water depth estimates by wetland number
C-2	7- 6-78		#1-dry;#2-aver. 20"	C-2-C	7- 6-78		#1-max.34", aver. 20";#2--22-24";#3-aver. 19"
	7-26-78		#2-aver. 17"		7-26-78		#1-aver. 22-24";#2-aver. 19";#3-aver. 15"
	5- 4-79	22	#1--10-12";#2-max. 34", aver. 29";#3--12"		5- 3-79	22	
	5-25-79	16	#1--6-9";#2--18-27";#3-max. 18"		5-24-79	18	#3-12"
	6-21-79	16	#1--9";#2--21-27";#3-range 9-21"		6-22-79	17	#1--18-24";#2--12-21"
	7-11-79	12	#1-dry;#2--9-33", aver. 24";#3--15-18"		7-12-79	12	#2--9-18";#3-almost dry
	7-23-79	9	#2--9-30", aver. 18-24";#3-max. 18"		7-24-79	12	#1--12-18"
	4-17-80	7	#1--9-15";#2-max. 36-42" aver. 18-24";#3 max. 18"		4-17-80	6	#1-max. 24";#2 max. 15";#3-almost dry
	5-13-80	8	#1-max. 6", aver. 2-3";#2-max. 24", aver. 18";#3 max. 24", aver. 12"		5-13-80	2	#1-max. 15", aver. 6-9";#2-max. 12", aver. 6-9"; #3-dry
	6- 6-80	9	#1-max. 8", aver. 4";#2-aver. 27"; #3--12-24"		6- 5-80	4	#1-max. 9", aver. 4-5";#2-max. 15", aver. 6-8";#3-max. 3"
	6-30-80	8	#1-soggy;#2-max. 30", aver. 21-24" #3-max. 21"		7- 1-80	3	#1-aver. 3-6", except 9-15" in channel;#2-max. 15" aver. 9"; #3-dry
	7-28-80	8	#1-dry;#2-aver. 15";#3-aver. 10-12"		7-28-80	0	#1 and #3-dry;#2-max. 2-4"
	4-23-81	0	#1-soggy 2";#2-max.18"; #3-max.,12-15";#1 dugout 3/4 full, #3 dugout full		4-24-81	0	All 3 wetl. dry, channel in wetland #1-max. 3-4", dugout ½ full
C-1	This study site lost to WBP, replaced by C-1-(R) in 1979.			C-1-C	7- 7-78		22-24"
					7-27-78		17"
C-1-(R)					4-18-79	17	
	6- 8-79	27	#1N--15-24", #1S-Aver. 12";#3-dry		6- 8-79	15	
	6-22-79	28	#2--9"		6-21-79	20	12-33"
	7-12-79	23	#2-max. 3"		7-11-79	16	15-24"
	7-24-79	22	#2-almost dry,max. 1"		7-23-79	13	12-24"
	4-22-80	22	#1N-aver. 5-6", max. 42" in ditch; #2--4-5";#3-dry		4-22-80	10	
	5-14-80	19	#1N-aver. 2" in wetland, max. 54" in ditch;#2-dry		5-14-80	5	Max. 18", aver. 12"
	6- 6-80	21	#1N-3", max. 42" in ditch;#2--1-2"		6- 6-80	4	Max. 18", aver. 12-15"
	7- 1-80	18	#1N-only water in ditch;#1S-max. 4"; #2&#3-dry		7- 1-80	0	
	7-29-80	14	#1N&1S-water in ditches 21-36"		7-29-80	0	Max. 5", aver. 3"
	4-24-81	0	All 3 wetlands dry, ditches 12-24"; #1 dugout -3/4 full, #2 dugout -½ full		4-23-81	0	Wetland dry, dugout 3/4 full

Table 1. Number of duck breeding pairs censused on 10 WBP and 10 non-WBP study sites, 1978-1981.

Year	Breeding Pairs[a]				
	WBP		non-WBP		Total
	Number	Percent	Number	Percent	Number
1978	1,337	55	1,107	45	2,444
1979	697	52	633	48	1,330
1980	233	40	345	60	578
1981[b]	26	47	29	53	55
4-Year Total	2,293[n.s.]	52	2,114	48	4,407

[a] The number of breeding pairs observed on each study site in each yesr is provided in Appendix F.

[b] Each study site was censused only once in 1981, compared to 3 censuses per site per year during 1978-1980.

n.s. Not significant

Fourteen species of ducks (Table 2) were recorded (six diver and eight dabbler species). Dabblers made up 83 percent, divers 16 percent, and unidentified ducks 1 percent of the 4,407 pairs recorded. The most common species in order of abundance were blue-winged teal (Anas discors), mallard (A. platyrhynchos), redhead (Aythya americana), northern shoveler (Anas clypeata), and common pintail (A. acuta). Diving duck populations responded dramatically to changing water conditions. In 1978, diving ducks made up 22 percent of the total pairs, compared to only 3 percent in 1980.

Of 110 duck nests found during 1978-1980, 62 percent were located on the WBP sites (Appendix G). Divers made up 48 percent (three species) and dabblers 52 percent (six species) of the total found. The most common nests found were redhead (38 percent), blue-winged teal (26 percent), and mallard (19 percent).

Table 2. Species composition of 4,407 duck breeding pairs recorded on 10 WBP and 10 non-WBP study sites, 1978-1981.

Species[a]	Number of Pairs (Percent WBP/Percent non-WBP)												4-Year Total	Percent of Total Pairs	Percent of Pairs on WBP	Percent of Pairs on non-WBP
	1978			1979			1980			1981						
Blue-winged teal	928	56[b]	44[c]	563	55	45	214	27	73	19	32	68	1724	39	52	48
Mallard	244	52	48	185	55	45	147	59	41	16	56	44	592	13	55	45
Northern shoveler	281	54	46	134	54	46	53	38	62	4	25	75	472	11	52	48
Common pintail	277	48	52	139	52	48	34	44	56	5	60	40	455	10	49	51
Gadwall	113	47	53	103	42	58	82	37	63	4	100	0	302	7	43	57
Green-winged teal	43	51	49	34	56	44	19	53	47	4	0	100	100	2	51	49
American wigeon	12	50	50	4	25	75	9	33	67	0	0	0	25	1	40	60
Wood duck	1	100	0	0	0	0	2	100	0	0	0	0	3	Tr[d]	100	0
Total Dabblers	1899	54	46	1162	53	47	560	40	60	52	44	56	3673	83	51	49
Redhead	433	60	40	92	59	41	10	30	70	1	100	0	536	12	60	40
Ruddy duck	45	33	67	14	36	64	0	0	0	0	0	0	59	1	34	66
Lesser scaup	15	67	33	38	21	79	4	25	75	0	0	0	57	1	33	67
Canvasback	36	58	42	7	57	43	2	100	0	0	0	0	45	1	60	40
Ring-necked duck	1	0	100	8	38	62	2	100	0	2	100	0	13	Tr	54	46
Bufflehead	0	0	0	1	0	100	0	0	0	0	0	0	1	Tr	0	100
Total Divers	530	58	42	160	46	54	18	44	56	3	100	0	711	16	55	45
Unidentified	15	87	13	8	38	62	0	0	0	0	0	0	23	1	70	30
Total	2444	55	45	1330	52	48	578	40	60	55	47	53	4407	100	52	48

[a] Latin names are provided in Appendix H.
[b] Percent recorded on WBP sites
[c] Percent recorded on non-WBP sites
[d] Tr = less than 0.5%.

Duck Broods

Of 358 broods recorded during 1978-1980, 51 percent were located on non-WBP sites (Table 3 and Appendix F). Brood occurrence on WBP and non-WBP sites was not significantly different. The decrease in brood numbers recorded from 1978 to 1980 was 92 percent on WBP and 90 percent on non-WBP sites.

Table 3. Number of duck broods censused on 10 WBP and 10 non-WBP study sites, 1978-1980.

Year	Broods[a]				
	WBP		non-WBP		Total
	Number	Percent	Number	Percent	Number
1978	122	51	118	49	240
1979	44[b]	46	52	54	96
1980	10	45	12	55	22
3-Year[c] Total	176	49	182[n.s.]	51	358

[a] The number of broods observed on each study site in each year is included in Appendix F.

[b] Two censuses made on esch site per yesr during 1978-1980, except in 1979 when only s single census was made on one of the 10 WBP sites.

[c] Duck broods were not censused in 1981.

n.s. Not significant

Dabblers made up 90 percent, unidentified 6 percent, snd divers 4 percent of the duck broods observed (Table 4). Broods were recorded for 10 (four divers and six dabblers) of the 14 species counted during breeding psir counts. Three species of diving duck broods and six species of dabbling duck broods were recorded on the WBP and non-WBP sites. Four dsbbler species account for 80 percent of all broods recorded: blue-winged teal (36 percent), common pintail (18 percent), msllard (14 percent), and northern shoveler (12 percent). Divers msde up 4 percent of the broods counted and 16 percent of the breeding pairs (Table 2).

Table 4. Species composition of 358 duck broods recorded on 10 WBP and 10 non-WBP study sites, 1978-1980.

Species[a]	Number of Broods (Percent WBP/Percent non-WBP)									3-Year Total	Percent of Total Broods	Percent of Broods on WBP	Percent of Broods non-WBP
	1978			1979			1980						
Blue-winged teal	82	60[b]	40[c]	42	50	50	6	50	50	130	36	56	44
Common pintail	47	40	60	14	29	71	3	0	100	64	18	36	64
Mallard	31	52	48	12	50	50	6	67	33	49	14	53	47
Northern shoveler	32	59	41	9	67	33	3	0	100	44	12	57	43
Gadwall	11	27	73	7	43	57	2	50	50	20	6	35	65
Green-winged teal	10	70	30	6	33	67	0	0	0	16	4	56	44
Total Dabblers	213	53	47	90	47	53	20	40	60	323	90	51	49
Redhead	5	20	80	2	0	100	0	0	0	7	2	14	86
Ruddy duck	3	0	100	1	0	100	0	0	0	4	1	0	100
Lesser scaup	1	0	100	0	0	0	1	100	0	2	Tr[d]	50	50
Canvasback	2	100	0	0	0	0	0	0	0	2	Tr	100	0
Total Divers	11	27	73	3	0	100	1	100	0	15	4	27	73
Unidentified	16	38	62	3	67	33	1	100	0	20	6	45	55
Total	240	51	49	96	46	54	22	46	54	358	100	49	51

[a] Latin names are provided in Appendix H
[b] Percent recorded on WBP sites
[c] Percent recorded on non-WBP sites
[d] Tr = less than 0.5%

Adult and Young Coots

Of 1,993 adult coots recorded during the 4-year period, 53 percent were located on non-WBP sites (Table 5). The number of adult coots recorded decreased by 88 percent from 1978 to 1980, with the magnitude of decrease being less on WBP sites. Of 465 coot nests located during 1978-1980, 71 percent were found on the non-WBP sites (Appendix G). The number of nests found decreased from 438 in 1978 to only two in 1980.

Table 5. Number of adult American coot observed on 10 WBP and 10 non-WBP study sites during duck breeding pair censuses, 1978-1981.

Year	Number of Coots				
	10 WBP		10 non-WBP		Total
	Number	Percent	Number	Percent	All Sites
1978	598	42	813	58	1411
1979	187	46	221	54	408
1980	143	83	30	17	173
1981	1	100	0	0	1
4-Year Total	929	47	1064[n.s.]	53	1993

n.s. = not significant

Seventy-eight percent of young coots observed during the 3-year period were recorded on non-WBP sites (Table 6). The number of young coots recorded decreased drastically from 1978 to 1980 (90 to 1). The small amount of data obtained on the occurrence of young coots was not sufficient to attempt a statiatical analysia. Analysis of adult coot data did not ahow a significant difference in relative use.

Table 6. Number of young American coot observed on 10 WBP and 10 non-WBP study aites during duck brood cenauaea, 1978-1980.

Year	Number of Coots				
	10 WBP		10 non-WBP		Total
	Number	Percent	Number	Percent	All Sites
1978	24	27	66	73	90
1979	2	6	30	94	32
1980	1	100	0	0	1
3-Year[b] Total	27	22	96	78[a]	123

[a] Statisticsl snalysis not attempted due to small sample size.
[b] Duck broods were not censuaed in 1981.

Adult Pheasants and Broods

Seventy-seven percent of adult pheasants observed were on WBP sites during 1978-1981 (Table 7). During each year a greater number was recorded on the WBP sites, with 34 percent more in 1980 and 78 percent more in 1981. On WBP sites, 2.1 pheasants were observed per hour of effort and on non-WBP sites 0.8 pheasants were observed per hour (Table 7). The number observed per hour on WBP increased from 0.2 in 1978 to 9.7 in 1981. On the non-WBP sites, the number per hour increased from 0.1 in 1978 to 2.1 in 1980, but decreased to 1.6 from 1980 to 1981. A significant difference ($P<0.01$) in the number of adult pheasants observed per hour on WBP sites was shown. All nine pheasant nests encountered during field activities in 1978-1980 were located on WBP sites.

Table 7. Number of adult ring-necked pheasants observed during all visits made to 10 WBP and 10 non-WBP study sites, 1978-1981.

Year	Pheasants Per Hour of Observation					
	10 WBP		10 non-WBP		All Sites	
	Pheasants per hour	Number Percent	Pheasants per hour	Number Percent	Pheasants per hour	Number
1978	0.2	28 70%	0.1	12 30%	0.1	40
1979	1.4	200 75%	0.5	66 25%	1.0	266
1980	2.9	351 67%	2.1	170 33%	2.6	521
1981	9.7	403 89%	1.6	52 11%	6.4	455
4-Year Average	2.1**	982 77%	0.8	300 23%	1.6	1282

** Highly significant, $P<0.01$.

Sixty-five percent of the pheasant broods and 72 percent of the young were recorded on WBP sites during 1978-1980 (Table 8). Average brood size was 6.8 young per brood on WBP and 4.8 on non-WBP sites. Except for 1978, the number of young and broods was greater on WBP as compared to non-WBP. Tests of significant differences were not conducted on these data due to the small sample sizes involved.

On WBP sites, 45 percent of the adult pheasants were observed in wetlands and 28 percent in cover composed mainly of tame grasses and legumes in combination with weedy annuals; the remaining 27 percent were observed in the 10 other cover types. Forty-eight percent of the broods were in tame-legume (31%) and tame-legume-weedy annual cover (17%), and 17 percent in wetlands; 35 percent were located in 5 of the 10 remaining cover types.

The majority (52%) of adult pheasants on non-WBP sites occured in wetlands, 21 percent in cropland, 10 percent in trees, and 17 percent on 3 of the 4 remaining land uses. None were observed on farmsteads. Fifty percent of the broods were located in cropland, 36 percent in trees, and 7 percent each in hay and pasture (none observed on the 4 other land uses).

Table 8. Number of ring-necked pheasant broods and young observed during all visits made to 10 WBP and 10 non-WBP study sites, 1978-1980.

Year	Pheasant Broods and Young					
	WBP		non-WBP		Combined	
	Number of Broods	Number of Young	Number of Broods	Number of Young	Number of Broods	Number of Young
1978	2 (50%)	2 (12%)	2 (50%)	15 (88%)	4	17
1979	5 (71%)	32 (89%)	2 (29%)	4 (11%)	7	36
1980	17 (65%)	130 (75%)	9 (35%)	44 (25%)	26	174
3-Year Total	24[a] (65%)	164[a] (72%)	13 (35%)	63 (28%)	37	227

[a] Statistical analysis not attempted due to the small sample size.

Other Wildlife

During 1978-1981, 122 bird species other than ducks, coots, and pheasants, were observed on the study sites (see Appendix H). One hundred and six species were observed on WBP sites and 97 were observed on non-WBP sites. Over the 4-year period the number of other bird species observed per hour of effort averaged 8.5 on WBP and 8.9 on non-WBP (Table 9). The other bird species count data did not demonstrate definite trends in relative use as the years progressed. Statistical analysis revealed no significant difference in use between WBP and non-WBP sites.

Table 9. Average number of bird species (excluding ducks, coots, and pheasants) observed per hour of effort spent on 10 WBP and 10 non-WBP study sites, 1978-1981.

Year	Number of Species Observed per Hour		
	WBP	non-WBP	Combined
1978	6.0	6.4	6.2
1979	10.8	8.9	9.8
1980	8.8	12.6	10.7
1981	5.0	5.6	5.3
4-Year Average	8.5	8.9[n.s.]	8.7

[n.s.] = not significant

Fourteen mammal species (Appendix H), excluding small mammals, were observed over the 4-year period (12 each on WBP and non-WBP). The presence of beaver (Caator canadensis) and plains pocket gopher (Geomys bursarius) on the study areas was indicated though they were never actually observed. During 1978-1981, the number of mammal species observed per hour averaged 0.6 on WBP and 0.8 on non-WBP (Table 10). During each year the number per hour was greater on non-WBP, but the differences were small. A statistical analysis was not performed since the amount of data obtained was insufficient.

Table 10. Average number of mammal species[a] observed per hour of effort spent on 10 WBP and 10 non-WBP study sites, 1978-1981.

Year	Number of Species Observed per Hour		
	WBP	non-WBP	Combined
1978	0.5	0.6	0.6
1979	0.6	0.7	0.6
1980	0.8	1.2	1.0
1981	0.8	1.0	0.9
4-Year Average	0.6	0.8[b]	0.7

[a] Excluding the small mammal species (mice, shrews, and voles).
[b] Statistical analysis not attempted due to small sample size.

Eight species of small mammals were captured on WBP sites and six on non-WBP sites during snap-trapping conducted in 1978 and 1979 (Appendix I). Ninety specimens were caught on WBP (910 traps set) and 71 (911 traps set) on non-WBP, for catch rates of 8.8 percent and 7.8 percent, respectively. Deer mouse (Peromyscus maniculatus) was the most common species caught, accounting for 56 percent of the individuals captured on WBP and 75 percent on non-WBP land. The meadow vole (Microtus pennsylvanicus) comprised 21 percent of the individuals on WBP and 15 percent on non-WBP. The remaining species each made up less than five percent of the total number.

Most other wildlife species used both WBP and non-WBP areas, although some species were more abundant on either WBP or non-WBP. Count data for four species of mammals and nine species of other birds were selected because a fairly reliable count of the number of individuals had been made and the quantity of data obtained was sufficient to make comparisons (Appendix J). Over three-fourths of the young and adult whitetail deer (Odocoileus virginianus) and short-eared owl (Asio flammeus) were observed on the WBP sites. Apparent use of WBP sites was also greater for the following species: red fox (Vulpes fulva), great-horned owl (Bubo virginianus), and northern harrier (Circus cyaneus).

Seventy percent of the whitetail jackrabbits (Lepus townsendi) and 65 percent of the gray partridge (Perdix perdix) were observed on non-WBP sites. For the remaining bird and mammal species, the difference in use of WBP and non-WBP sites was not very apparent with the difference in use ranging from 2 to 14 percent.

Forty-nine percent of the deer (young and adult combined) were located in wetland cover on WBP sites, 35 percent in tame grass-legume in combination with weedy annuals (8% in treea). On non-WBP sites, 46 percent of the deer were observed in wetlands, 22 percent in trees, 19 percent in cropland (mostly corn), and 13 percent in hay, pasture, and "other" cover types.

The frequency of occurrence of all species of wildlife observed on the study sites during 1978-1981 is summarized in Appendix H. An "occurrence" signifies that at least one individual of a species was observed on a site during a single visit. The "frequency of occurrence" ia the number of visits during which a particular species was observed divided by the total number of visits made. The following discussion concerns only those species for which the frequency of occurrence was at least 10 percent on both WBP and non-WBP, and the relative difference in use was at leaat 1.5 times greater.

The following species exhibited greater use of WBP sites: northern harrier (1.8X), great-horned owl (1.8X), tree swallow (Iridoprocne bicolor) (2.3X), bank awallow (Riparia riparia)

(1.5X), marsh wren (Cistothorus palustris) (1.5X), common yellowthroat (Geothlypis trichas) (1.8X), bobolink (Dolichonyx oryzivorus) (2.8X), dickcissel (Spiza americana) (2.7X), song sparrow (Melospiza georgiana) (2.0X), canvasback (Aythya valiaineria) (1.6X), ring-necked pheasant (1.7X), and whltetail deer (2.9X). Greater use of non-WBP sites was shown for killdeer (Charadrius vociferus) (1.6X), Richardson ground squirrel (Citellus richardsoni) (1.8X), and whitetail jackrabbit (1.6X).

Ubiquitous species such as yellow-headed blackbird (Xanthocephalus xanthocephalus), red-winged blackbird (Agelaius phoeniceus), western meadowlark (Sturnella neglecta), common grackle (Quiscalus quiscula), brown-headed cowbird (Molothrua ater), and barn swallow (Hirundo rustica), occurred frequently, and exhibited very little difference in use of WBP and non-WBP sites (Appendix H). Little difference in use was shown by the arboreal-nesting red-tailed hawk (Buteo jamaicensis) and Swainson's hawk (B. swainsoni), in contrast to the northern harrier, a ground-nesting hawk, which occurred more frequently on the WBP sites. The ground-nesting short-eared owl showed a slight preference for WBP. Two ground-nesting sparrows, the grasshopper sparrow (Ammodramus savannarum) and the clay-colored sparrow (Spizella pallida), showed a greater preference for WBP sites. The three species of ground squirrels were observed on non-WBP sites 48 percent of thc time compared to only 25 percent on the WBP sites. The gray partridge, horned lark (Eremophila alpestris), and chestnut-collared longapur (Calcarius ornatus) appearcd to prefer non-WBP sitca. Little difference in frequency of occurrence was evident for duck species, except that the ruddy duck (Oxyura jamaicensia) was 2.2 times more frequent on non-WBP sites.

Wildlife count data collected on the 20 individual study area aites is summarized in Appendix K. Comparisons of these count data on individual sites can be used with the photos and descriptions in Appendix D to compare how habitat characteristics of particular sites may influence wildlife uaage.

Neat Search

Eighteen pheaaant nests were found on 66.8 acres (0.3 nests/acre) on 10 WBP sites searched during June through August 1981 (Table 11). No pheasant neats were found in four of the nine cover types searched. Highest pheasant nest density was recorded on the weedy annual cover type (0.65), followed by legume (0.62), wetland (0.52), native-tame-legume (0.36), and tame-legume (0.20).

Table 11. Nests found on 10 WBP study sites during June-August 1981.

Cover Type	Acres of Cover Type Searched	Pheasant Nests		Number and Species of Other Nests Found
		Number	Number per Acre	
Tame-legume	25.1	5	0.20	1-Western meadowlark/ 1-unidentified duck
Wetland	11.5	6	0.52	2-Common yellowthroat/ 2-Northern harrier/1-Mourning dove/1-Sedge wren/1-unidentified sparrow
Native-tame-legume	11.1	4	0.36	1-Clay-colored sparrow
Tsme-legume-weedy annual	5.2	0	0.00	3-Clay-colored sparrow/ 1-Song sparrow/1-Gadwall
Tame	5.0	0	0.00	1-Field sparrow
Native	3.7	0	0.00	None
Legume	3.2	2	0.62	1-Dickcissel
Weedy annual	1.5	1	0.65	None
Tree	0.5	0	0.00	None
ALL COVER TYPES	66.8	18	0.27	17 nests of 10 species (2 nests unidentified)

Inferring from this limited amount of data, weedy annual, legume, and dry wetlands appeared to be the preferred cover types for nesting pheasants. Tame-legume was an abundant cover type, but it supported a nest density only one-third of that observed on dry wetland cover. Essentially pure stands of introduced or native grasses did not seem conducive to nesting. Grasses in combination with legumes and/or weedy annuals would seem more desirable than pure stands of grasses. Searching in the tree cover was insufficient to make any generalizations about the desirability of this cover type.

Seventeen active nests of 10 species other than pheasant were located on the WBP sites during nest search activities (Table 11). The species could not be identified for 2 of the 17 nests. No attempt was made to calculate nest densities

because a large number of nests were not found for any one species. Nests of the clay-colored sparrow were the most common with four nests found, followed by northern harrier and common yellowthroat, with two nests each. Only two duck nests, one gadwall (Anas strepera) and one unidentified, were found.

Seven nests were located in the wetland cover type, five in tame-legume-weedy annual, two in tame-legume, and one nest in each of the tame, native-tame-legume, and legume cover types. Three of the seven nests found in wetlands were of typical wetland-nesting species (common yellowthroat and sedge wren (Cistothorus platensis)). Northern harriers are known to nest on both the uplands and wetlands. A mourning dove (Zenaida macroura) nest was located in a wetland. This species is generally an arboreal nester although it is not uncommon to find incidences of ground nests in upland cover. Apparently dry wetlands provide suitable nesting habitat for certain species that normally would not nest there under wet conditions.

CONCLUSIONS AND MANAGEMENT IMPLICATIONS

Duck pair and brood use of WBP study sites differed little from that of non-WBP study sites during the four years of this field trial. Excellent water conditions prevailed during the first year, but a drought situation thereafter caused most wetlands on the study sites to be dry by the final year. In response, duck numbers decreased drastically from 1978 to 1981. Duck use of WBP sites was slightly greater during the first two years, but then became greater on non-WBP sites during the final two years.

As water conditions deteriorated, wetlands on WBP sites tended to fill with emergent vegetation as a result of non-use and low water levels. In contrast, most wetlands on non-WBP sites received moderately heavy grazing which prevented heavy growth of emergent vegetation.

Many msrsh birds make little use of continuous, unbroken stands of emergent vegetation on wetlands. The productivity of wetlands can be enhanced by providing interspersion of open water and emergents. At Delta Marsh, Manitoba, where cattle hsd trampled emergent vegetation near the shores, ducks used the srea for loafing (Sowls 1978). Ducks did not use areas where loafing edges were not available. Higher water levels would maintain a better interspersion of open water and emergents on WBP wetlands, and greater use of the wetlands could be expected in wetter years.

Pheasant use of WBP sites was significantly greater than on non-WBP sites. Both the number of adult and young pheasants observed on WBP sites increased considerably from 1978 to 1981, as the upland cover developed and the wetlands became dry. Pheasant nests were observed only on WBP sites. Average brood size was also somewhat larger on WBP sites.

The number of other wildlife species observed per hour on WBP sites varied little from the number per hour on non-WBP. Although other wildlife species as a whole showed little difference in use, particular species reacted to the disturbed and non-disturbed habitat available on the respective study area sites. Nearly three times as many deer were observed on the WBP sites, showing a preference for undisturbed wetlands. Species of ground-nesting raptors showed a positive response to the cover conditions on WBP sites. Several examples of other bird and mammal species making greater use of the diaturbed conditions on non-WBP sites were also evident.

A common treatment applied on WBP areas was to interseed legumes into monospecies stands of cool-season tame grasses. The established grasses were dominant and a good catch of the legume was not obtained where proper interseeding treatment was not accomplished. Intermediate wheatgrass responded better to legume interseeding than did smooth bromegrasa or crested wheatgrass. A characteristic of cool-seaaon tame grasses and legumes is their early growth in spring when nesting is initiated. The stands of legumes or grass-legumes seeded in fully prepared cropland sites were more successful, and an

added advantage to nesting was the tendency of weedy annuals to occur in this former cropland. Several nesting species took advantage of mixtures of tame grasses, legumes, and weedy annuals. Pheasants were often flushed from this type of cover.

Both upland and wetland habitat are more productive of wildlife in the first stages after establishment or disturbance. Pure stands of tame and native grasses seem especially susceptible to loss of vigor after long periods of non-use. Therefore, periodic disturbances are recommended.

Water conditions on WBP sites could be enhanced by giving preference to those wetlands characterized by more permanent water regimes as "qualifying wetlands" in WBP. These would include Type 4 or very strong Type 3 wetlands.

In addition, Type 3 wetlands could be evaluated for possible enhancement of their water conditions through the use of low head dikes and/or dams, or through systems of level ditches. Where these developments are feasible, they could be required and cost-shared.

Where conditions are feasible because fencing and livestock water are available, wetlands could receive specific grazing use designed to improve the interspersion of open water and emergent aquatic plants. Where grazing use is not practical, other techniques involving mowing, herbicides, prescribed burning, or blasting should be considered.

First priority in upland habitat development should be given to obtaining croplands which can be seeded to establish stands of dense nesting habitat. In addition to the current emphasis on seeding cool-season tame grasses and legumes, greater use could be made of native grasses, especially the warm-season, mid and tall grasses with particular emphasis on switchgrass, Indiangrass, and big bluestem.

Rangelands accepted as uplands in WBP should be evaluated for needed treatment when accepted, and periodically thereafter. Treatments to improve or maintain cover quality could involve, as feasible, specific grazing use, prescribed burning, and mowing and raking.

Improved guidelines are needed for establishing acceptable stands of legumes in tame grasses without full seedbed preparation and for maintaining these stands over a period of years.

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APPENDICES

Appendix A. Land use adjacent to the perimeter of 10 WBP and 10 non-WBP study sites, 1978-1981.

Study area sites	Total perimeter length of study sites (miles)	Length of[a] road along perimeter (miles)	Number[b] of fields	Percent of perimeter in various land uses and number of fields							
				Wetland	Tree	Pasture	Hay[c]	Cropland[d]	Alfalfa[e]	Farmstead[f]	Other[g]
10 WBP Sites	25.2	8.4	130	17 (19)[b]	3 (6)	21 (29)	1 (5)	39 (42)	11 (15)	3 (4)	5 (10)
10 non-WBP Sites	20.4	8.2	133	14 (25)	2 (4)	18 (21)	2 (6)	51 (56)	7 (7)	5 (7)	1 (7)
All Sites	45.6	16.6	263	15 (44)	2 (10)	20 (50)	2 (11)	44 (98)	9 (22)	4 (11)	4 (17)

[a] Roads bordering the study area sites are not considered as a land use, instead, the use occurring nearest the road is designated as the major land use and is placed in one of the 8 categories.

[b] The number of fields along the perimeter. The value in parenthesis given below the percentage values is the number of fields in each of the 8 land uses.

[c] The "Hay" category consists of tame and/or native grasses alone or in combination with alfalfa, whereas, pure stands of alfalfa are included under the "Alfalfa" category.

[d] Ten percent and 6 percent of the WBP and non-WBP perimeter, respectively, which is designated as "Cropland" included alfalfa in the 4-year cropping rotation (for either 1 or 2 years).

[e] Thirty-eight percent of the non-WBP perimeter designated as "Alfalfa" was part of a crop rotation.

[f] Consists only of occupied farmsteads and associated hay yards, silage pits, graneries, livestock holding pens, and shelter belts.

[g] Other includes abandoned farmsteads, gravel pit areas, railroad right-of-ways, grassed waterways, and miscellaneous idle lands.

Appendix B. Land uses occurring on the 10 non-WBP study sites, 1978-1981.

Total acres	Acres and number of wetlands	Acres and number of upland fields	Wetland[a]	Tree	Pasture	Hay	Cropland[b]	Alfalfa[c]	Farmstead	Other
1,621.0	386.5	1,234.5	24%	1%	30%	4%	31%	6%	2%	2%
	(21)	(54)	(21)[d]	(5)	(10)	(6)	(18)	(6)	(3)	(6)

[a] Of the 386.5 acres of wetlands 67% are Type-3 (16 basins) and 33% are Type-4 (5 basins) (Shaw and Fredine, 1956).
[b] Twelve percent of the acreage designated as "cropland" was tame hayland (smooth bromegrass) in 1978.
[c] Seventy-seven percent of the "alfalfa" acreage included cropping (small grains or row crops) uses during 1 or 2 years of the study.
[d] The value in parenthesis represents the number of occurrences ("fields") of the various land uses.

Appendix C. Cover types occurring on the 10 WBP study sites, 1978-1981.

Total acres	Acres and number of wetlands	Acres and number of upland fields[b]	Cover Type Designations[a] (percent of total area in the various cover types)												
			W[c]	TR	T	N	L	T-L	T-N	L-WA	N-L	T-WA	T-N-L	T-L-WA	T-N-WA
1,723.0	367.5	1,355.5	21%	2%	1%	10%	4%	30%	5%	3%	2%	Tr[d]	11%	10%	1%
	(25)	(85)	(25)	(5)	(3)	(11)	(4)	(28)	(7)	(2)	(1)	(1)	(14)	(7)	(2)

[a] Key to cover types: W = wetland
TR = tree
T = tame grasses
N = native grasses
L = legumes (in most instances this consists of alfalfa)
WA = weedy annuals
The remaining upland cover types are various mixtures of T, N, L, and WA.

[b] The value in parenthesis represents the number of occurrences ("fields") of the various cover types.
[c] Of the 367.5 acres of wetlands 70% are Type-3 (21 basins) and 30% are Type-4 (4 basins) (Shaw and Fredine, 1956).
[d] Less than 1% of the total acreage consists of the T-WA cover type.

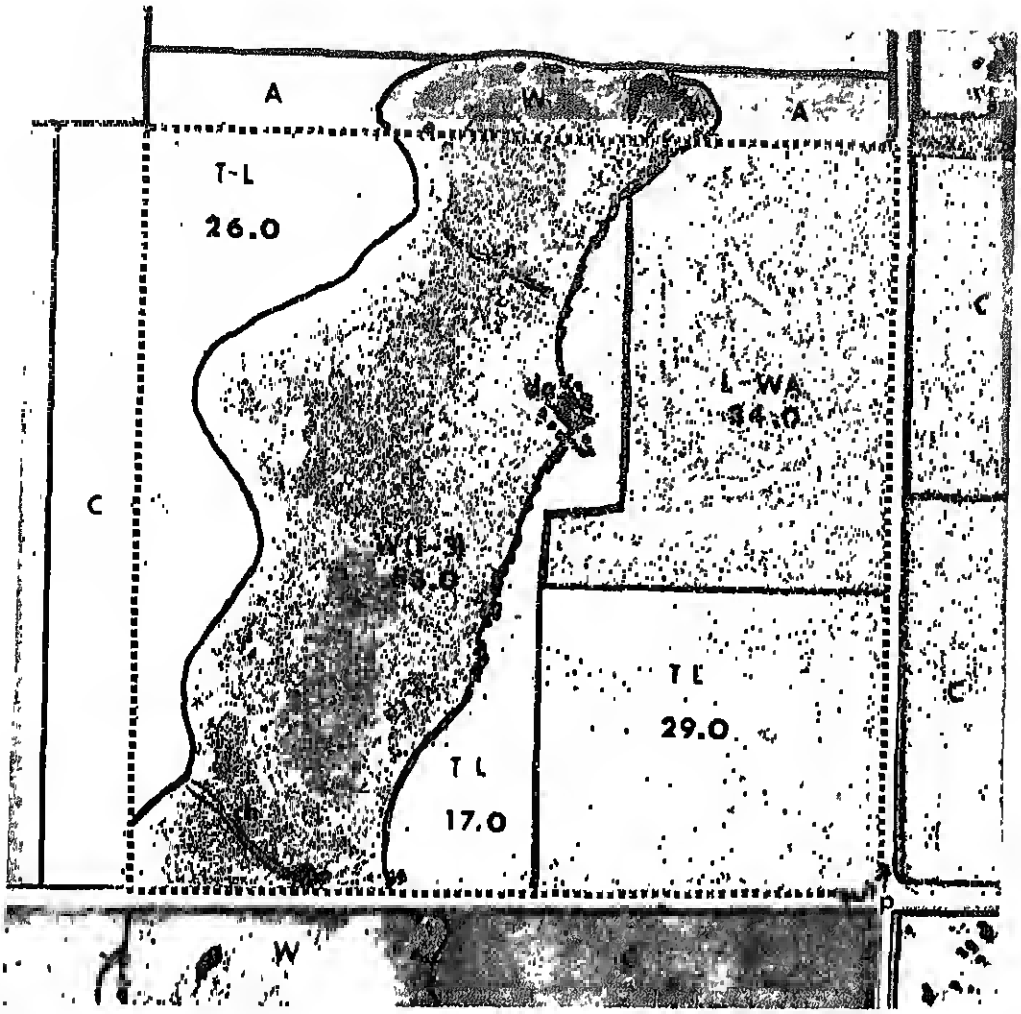
Appendix D. Aerial photographs of the 20 study sites.

Legend for Appendix D

Land Use-Cover Type* Symbols	A	alfalfa
	C	cropland
	F	farmstead
	H	hayland
	N	native
	O	other land use
	P	pasture
	T	tame grass
	TR	shelterbelts or woodlots
	W	wetland
	WA	weedy annuals
Other Symbols	ch	channel
	do	dugout
	gp	gravel pit
	r_u	unimproved road
	r_g	gravel road
	r_p	paved road
	W-1	wetland one
	W-2	wetland two
	T-3	type 3 wetland
	T-4	type 4 wetland
	⊗	location of water depth posts
	o	trees
	▪▪▪▪▪▪▪▪	study site boundary
	———	field borders

* The number below the land use - cover/type symbol is the field acreage to the nearest 0.5 acre.

Appendix D-1."K-6" WBP Study Site (1977 WBP Agreement). T. 109 N, R. 55 W, Sec. 23 (SE¼)



Scale - 8" = 1 mi.

N

Total Area 159 acres

33% Wetland
67% Upland

Cover Types on Study Site (percent of area; number of occurrences): Tame-legume (45%, 3); Wetland (33%, 1); Legume-weedy annuals (22%, 1).

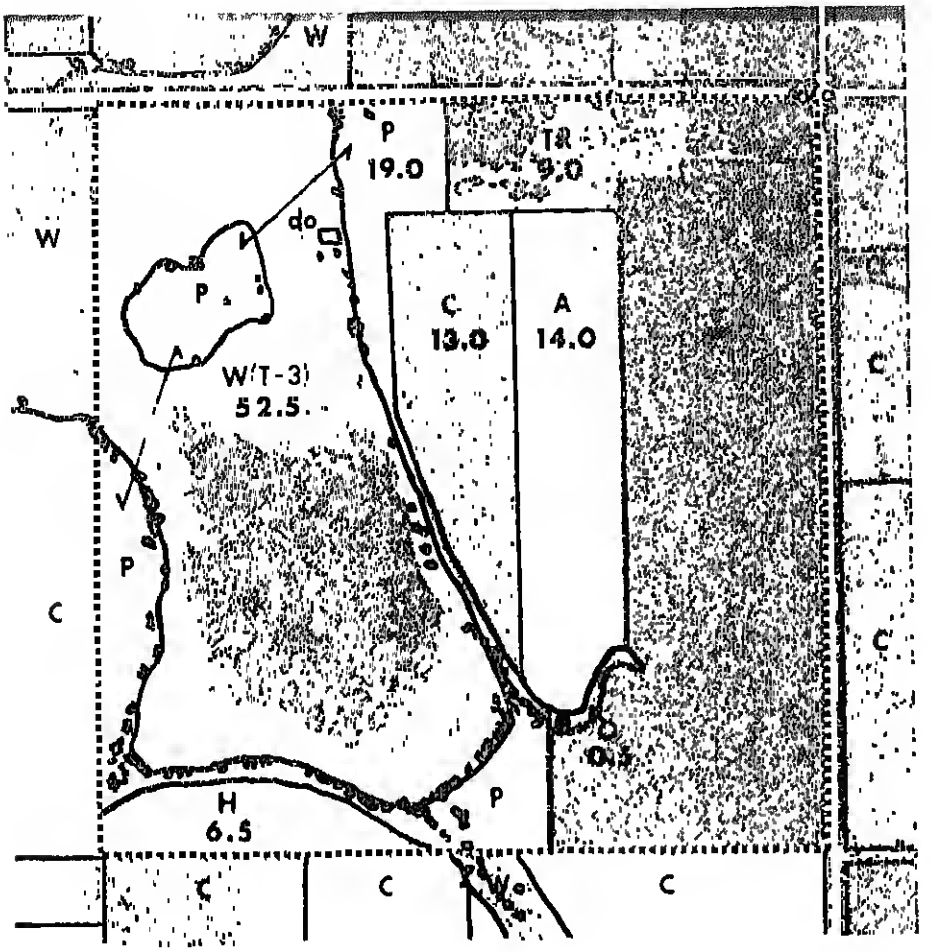
Land Use Adjacent to Study Site Perimeter (percent of perimeter in land use; number of occurrences): Perimeter length - 2.0 miles; Cropland (65%, 4); Wetland (21%, 2); Alfalfa (14%, 2).

Treatments: On April 28, 1977, alfalfa interseeded into tame grasses (3#/acre) on the 26.0 acre T-L and 17.0 acre T-L. The 34.0 acre L-WA field was cropland seeded to straight alfalfa (6.5#/acre).

Emergency Haying: No emergency haying occurred on this site. A limited amount of haying was done on the 34.0 acre field to control Canada thistle.

Notes: This study site waa purchased by the U.S. Fish and Wildlife Service as a Waterfowl Production Area after the study began. However, no further management was conducted other than that specified in the WBP agreement.

Appendix D-2. "K-6-C" non-WBP Study Site. T. 109 N, R. 54 W, Sec. 20 (NE¼)



Scale - 8" = 1 mi.

N

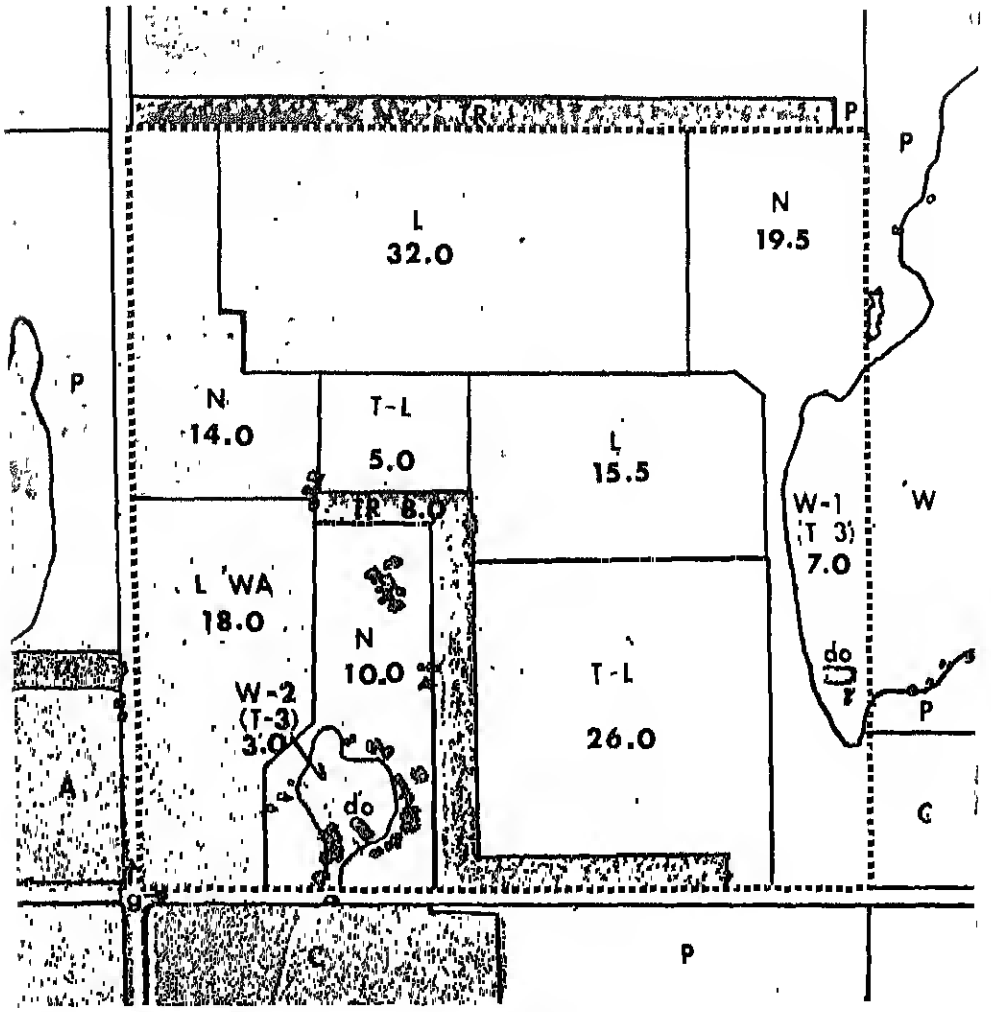
Total Area 159 acres

33% Wetland
67% Upland

Land Uses on Study Site (percent of area; number of occurrences): Cropland (36%, 2); Wetland (33%, 1); Pasture (12%, 1); Alfalfa (9%, 1); Tree (6%, 1); Hay (4%, 1); Other (trace, 1).

Land Use Adjacent to Study Site Perimeter (percent of perimeter in land use; number of occurrences): Perimeter length - 2.0 miles; Cropland (66%, 9); Wetland (22%, 3); Tree (6%, 1); Alfalfa (5%, 1); Other (1%, 1).

Appendix D-3. "K-4" WBP Study Site (1977 WBP Agreement). T. 110 N, R. 56 W, Sec. 9 (SW¼)



Scale - 8" = 1 mi.

N

Total Area 158 acres

6% Wetland
94% Upland

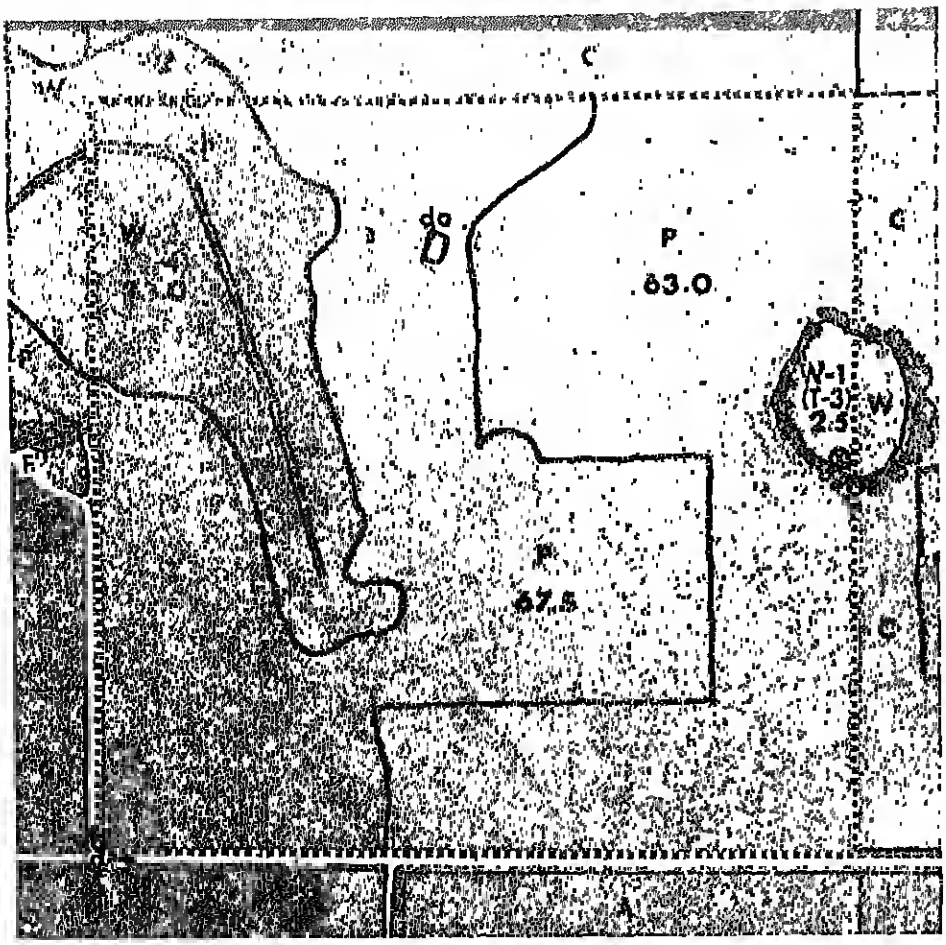
Cover Types on Study Site (percent of area; number of occurrences): Legume (30%, 2); Native (28%, 3); Tame-legume (20%, 2); Legume-weedy annual (11%, 1); Wetland (6%, 2); Tree (5%, 1).

Land Use Adjacent to Study Site Perimeter (percent of perimeter in land use; number of occurrences): Perimeter length - 2.0 miles; Pasture (40%, 5); Cropland (25%, 2); Wetland (11%, 1); Alfalfa (6%, 1); Tree (18%, 1).

Treatments: On April 25, 1977, alfalfa interseeded into tame grasses (3#/acre PLS) on the 5.0 acre T-L and 26.0 acre T-L fields. Existing cropland seeded to straight alfalfa (6.5#/acre) on the 18.0 acre L-WA, 15.5 acre L, and 32.0 acre L fields.

Emergency: Approximately 38% of area (all upland) hayed between July 23 and October 7, 1981. Involved the 14.0 acre N, 5.0 acre T-L, 15.5 acre L, and the 26.0 acre T-L fields.

Appendix D-4. "K-4-C" non-WBP Study Site. T. 110 N, R. 56 W, Sec. 21 ($SW\frac{1}{4}$)



Scale - 8" = 1 mi.

N

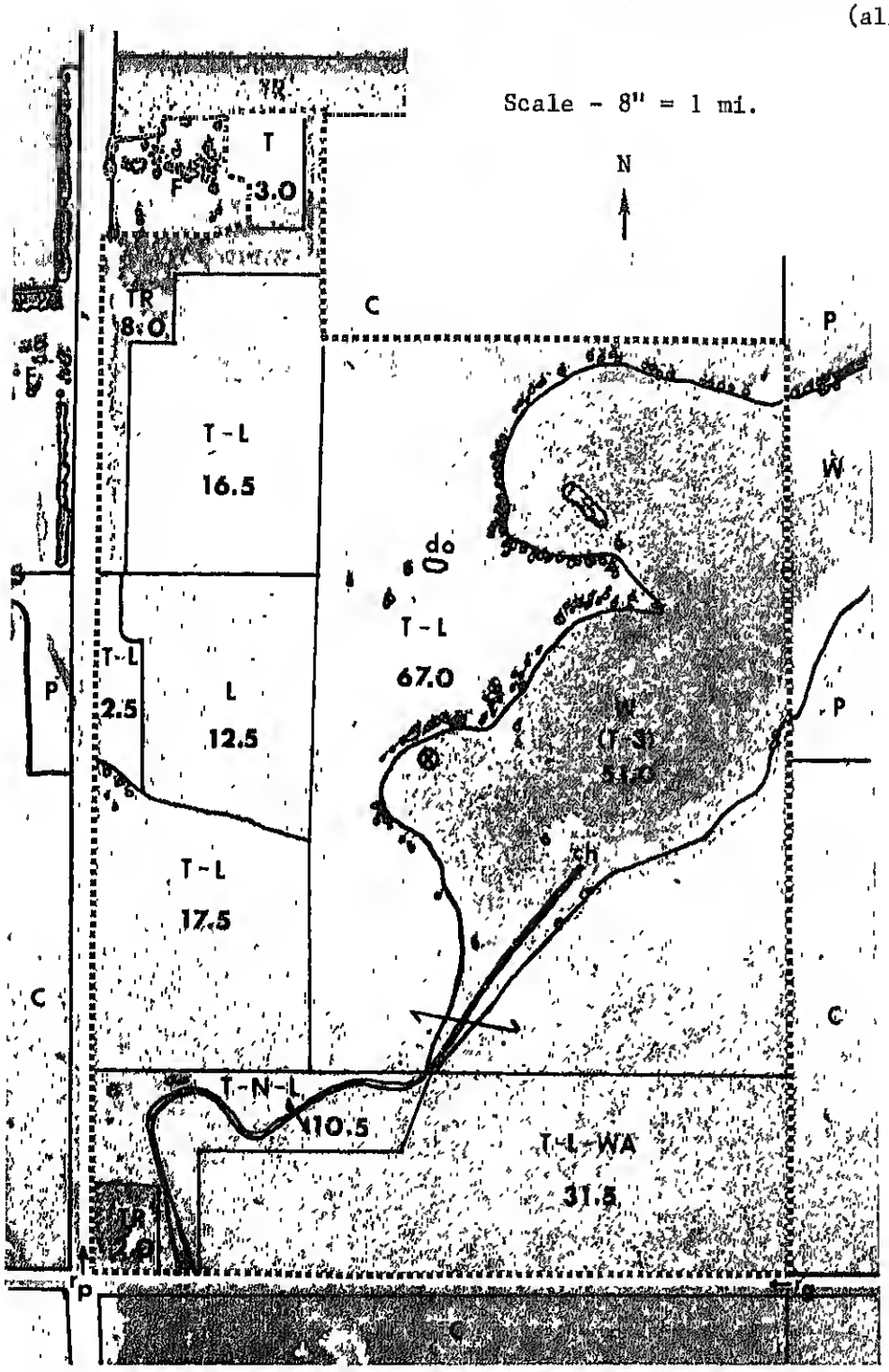
Total Area 158 acres

17% Wetland
83% Upland

Land Uses on Study Site (percent of area; number of occurrences): Wetland (17%, 2); Pasture (83%, 2).

Land Use Adjacent to Study Site Perimeter (percent of perimeter in land use; number of occurrences): Perimeter length - 2.0 miles; Cropland (50%, 5); Wetland (19%, 3); Alfalfa (15%, 1); Pasture (11%, 2); Farm (4%, 1); Other (1%, 2).

Appendix D-5. "K-3" WBP Study Site (1978 WBP Agreement). T. 112 N, R. 56 W, Sec. 34 (all SW¼, part NW¼)



Total Area 222 acres

23% Wetland
77% Upland

Cover Types on Study Site (percent of area; number of occurrences): Tame-legume (47%, 4); Wetland (23%, 1); Tame (1%, 1); Tame-legume-weedy annual (14%, 1); Legume (5%, 1); Tame-native-legume (5%, 2); Tree (5%, 2).

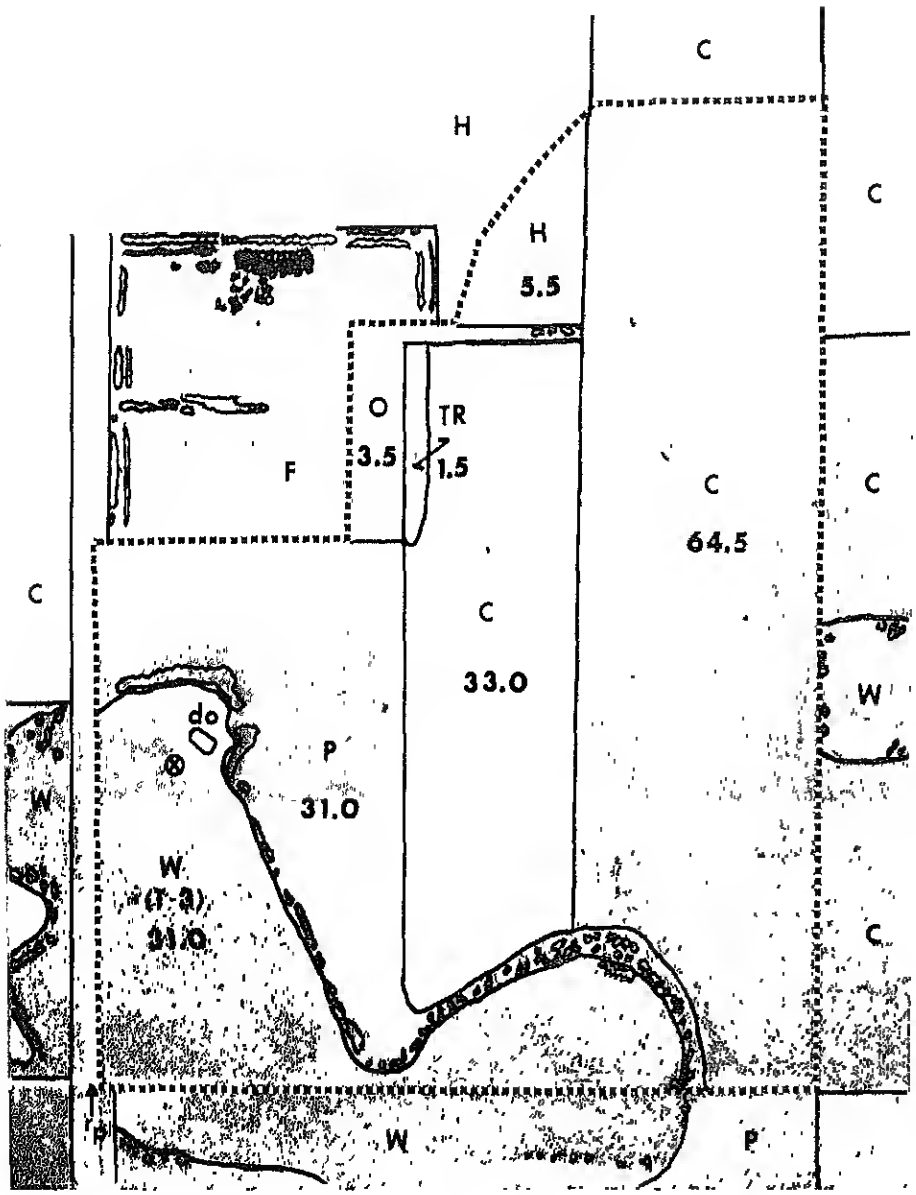
Land Use Adjacent to Study Site Perimeter (percent of perimeter in land use; number of occurrences): Perimeter length - 2.6 miles; Cropland (66%, 4); Farm (15%, 2); Psture (8%, 3); Wetlsnd (8%, 1); Tree (3%, 1).

Treatments: On April 26, 1978, alfalfa interseeded into 137 acres of tame grasses at 3#/acre. This involved all upland fields except the 2.0 acre TR, 8.0-acre TR, 2.5 acre T-L, and the 12.5 acre L fields.

Emergency Haying: No emergency haying occurred on this site.

Notes: This study site was in Soil Bank from approximately 1955-56 until 1964-65, and was pastured thereafter until entering the WBP in 1978.

Appendix D-6. "K-3-C" non-WBP Study Site. T. 112 N, R. 56 W, Sec. 15 (parts of SW¼ & NW¼)



Scale - 8" = 1 mi.

N

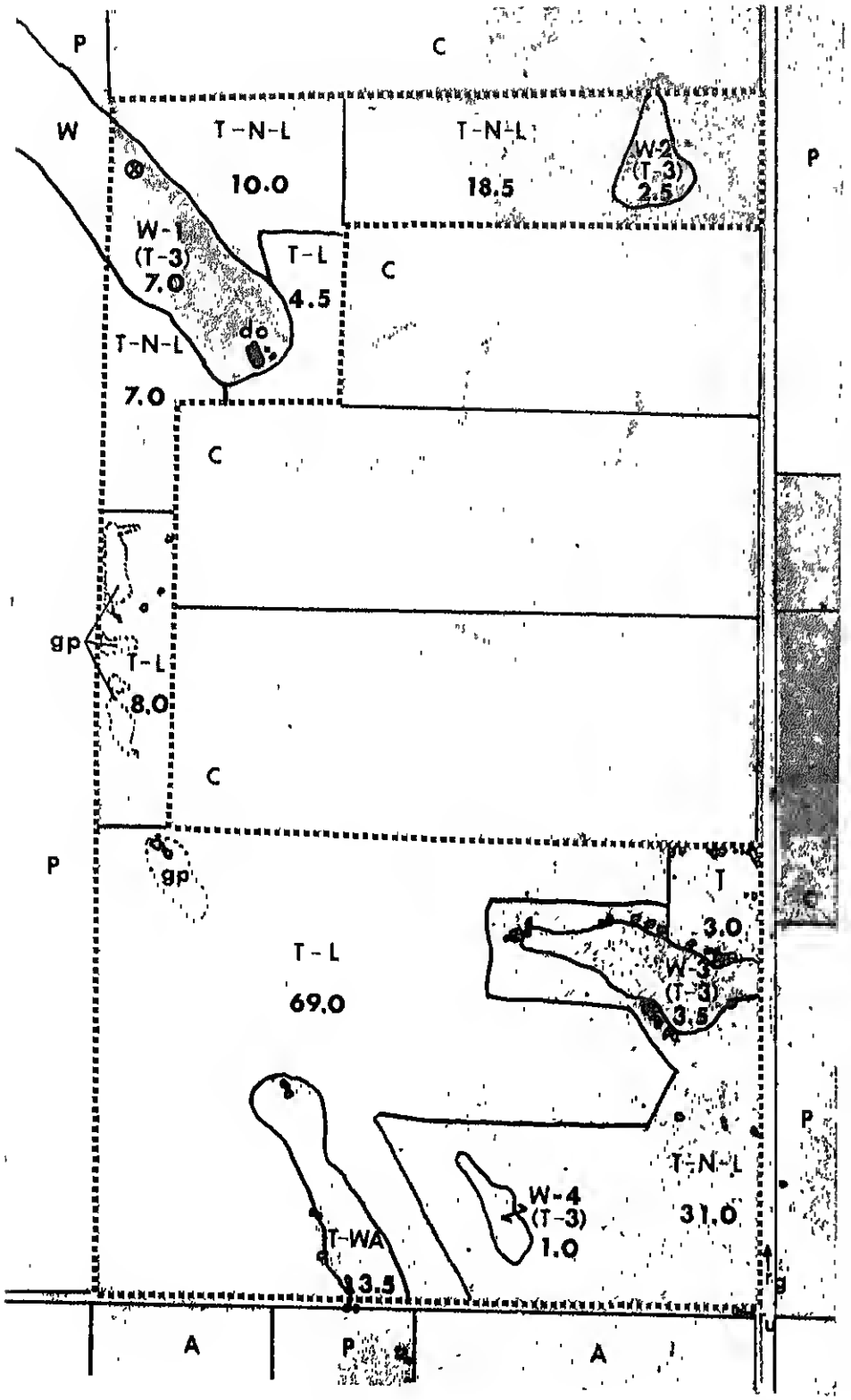
Total Area 170 acres

18% Wetland
82% Upland

Land Uses on Study Site (percent of area; number of occurrences): Cropland (58%, 2); Wetland (18%, 2); Pasture (18%, 1); Hay (3%, 1); Other (2%, 2): Tree (1%, 1).

Land Use Adjacent to Study Site Perimeter (percent of perimeter in land use; number of occurrences): Perimeter length - 2.3 miles; Cropland (38%, 5); Wetland (33%, 3); Farm (17%, 1); Hay (8%, 2); Pasture (4%, 2).

Appendix D-7. "K-2" WBP Study Site (1978 WBP Agreement). T. 112 N, R. 57 W, Sec. 35 (parts of SW¼ and NW¼)



Scale - 8" = 1 mi.

N

Total Area 165 acres

9% Wetland
91% Upland

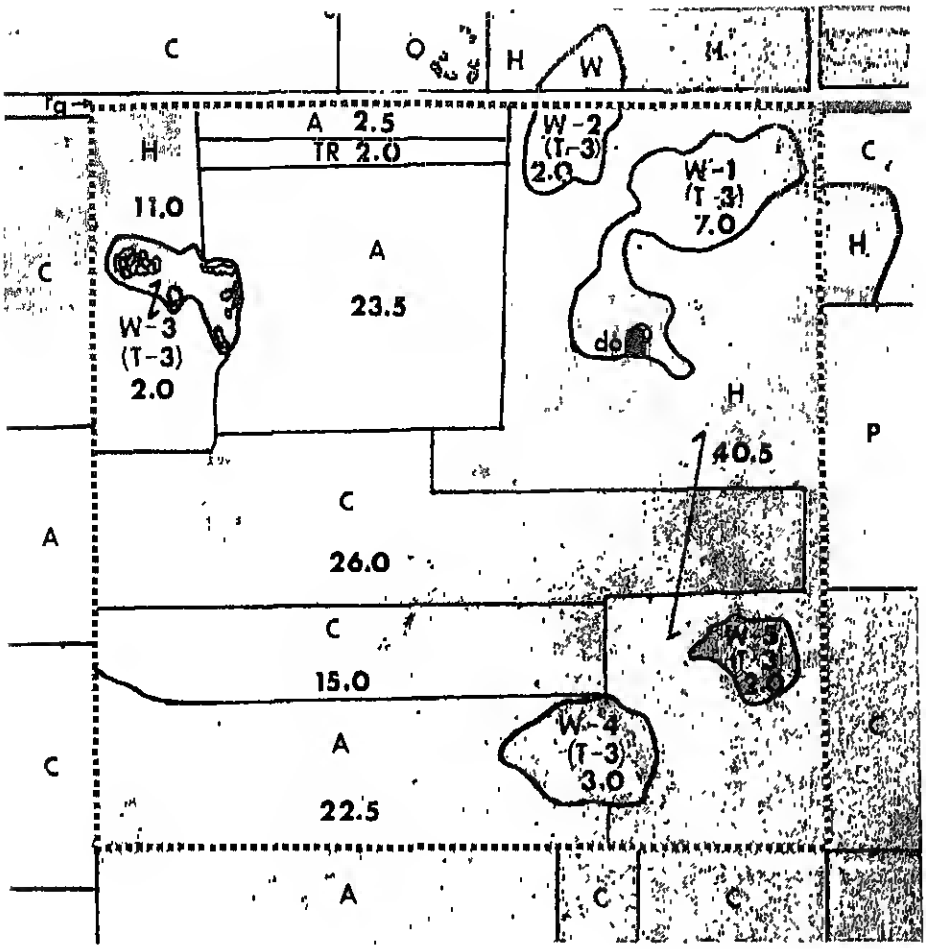
Cover Types on Study Site (percent of area; number of occurrences): Tame-legume (47%, 3); Tame-native-legume (40%, 4); Wetland (9%, 4); Tame (2%, 1); Tame-weedy annual (2%, 1).

Land Use Adjacent to Study Site Perimeter (percent of perimeter in land use; number of occurrences): Perimeter length - 3.6 miles; Cropland (51%, 5); Pasture (35%, 5); Alfalfa (11%, 2); Wetland (3%, 1).

Treatments: On April 15, 1978, alfalfa interseeded into tame grasses at a rate of 3#/acre. No interseeding on the 3.0 acre T field and parts of the 3.5 acre T-WA, 8.0 acre T-L, and 31.0 acre T-N-L fields.

Emergency Haying: Approximately 11% of area hayed between July 11 and August 7, 1980. Involved the 18.5 acre T-N-L field.

Appendix D-8. "K-2-C" non-WBP Study Site (1978 WBP Agreement). T. 111 N, R. 57 W, Sec. 13 (NE¼)



Scale - 8" = 1 mi.

N

Total Area 159 acres

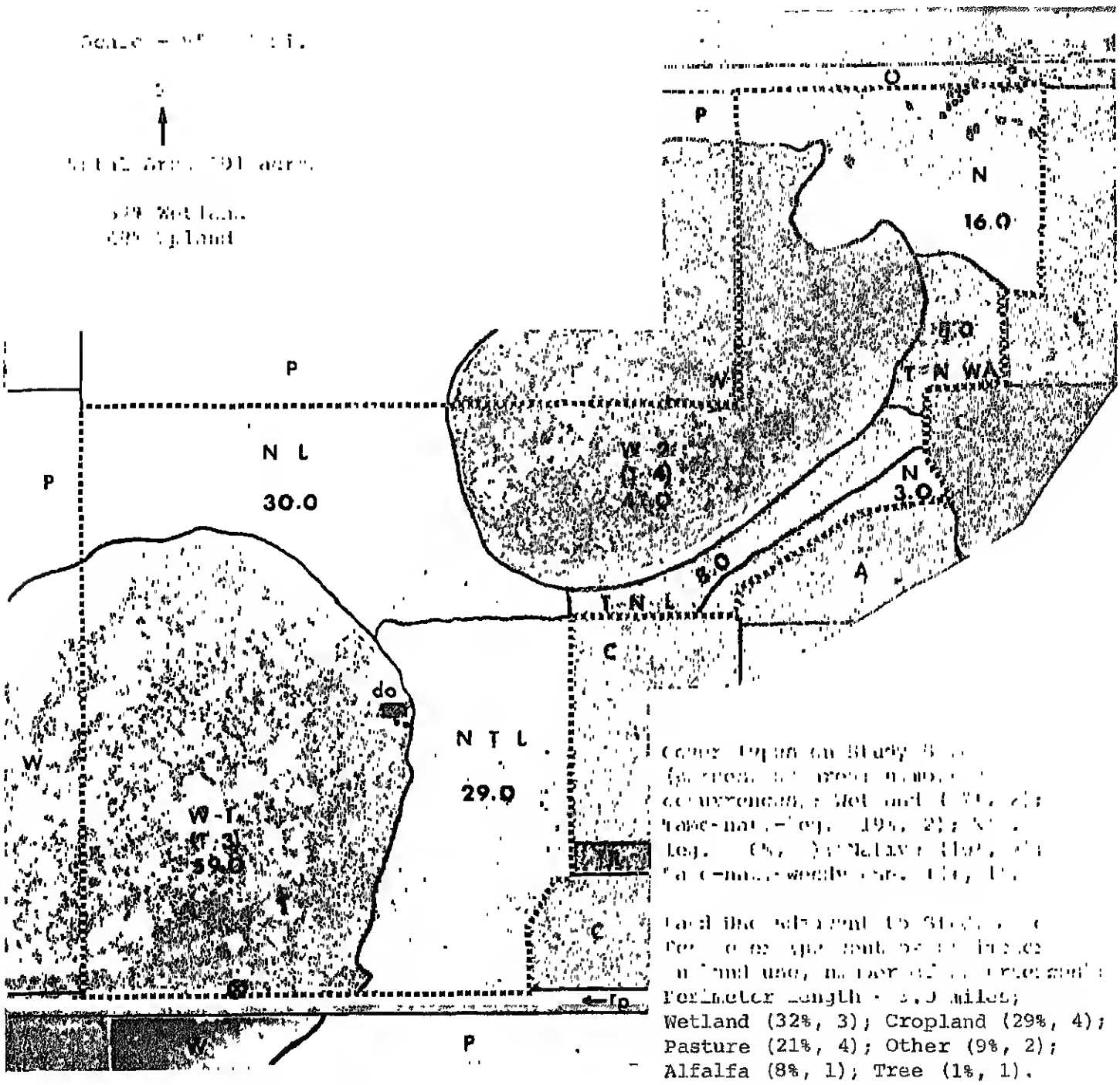
10% Wetland
90% Upland

Land Uses on Study Site (percent of area; number of occurrences): Hay (33%, 2); Alfalfa (30%, 3); Cropland (26%, 2); Wetland (10%, 5); Tree (1%, 1).

Land Use Adjacent to Study Site Perimeter (percent of perimeter in land use; number of occurrences): Perimeter length - 2.0 miles; Cropland (48%, 7); Alfalfa (23%, 2); Hay (12%, 3); Pasture (9%, 1); Other (5%, 2); Wetland (3%, 2).

Comments: Wetlands on this site were hayed.

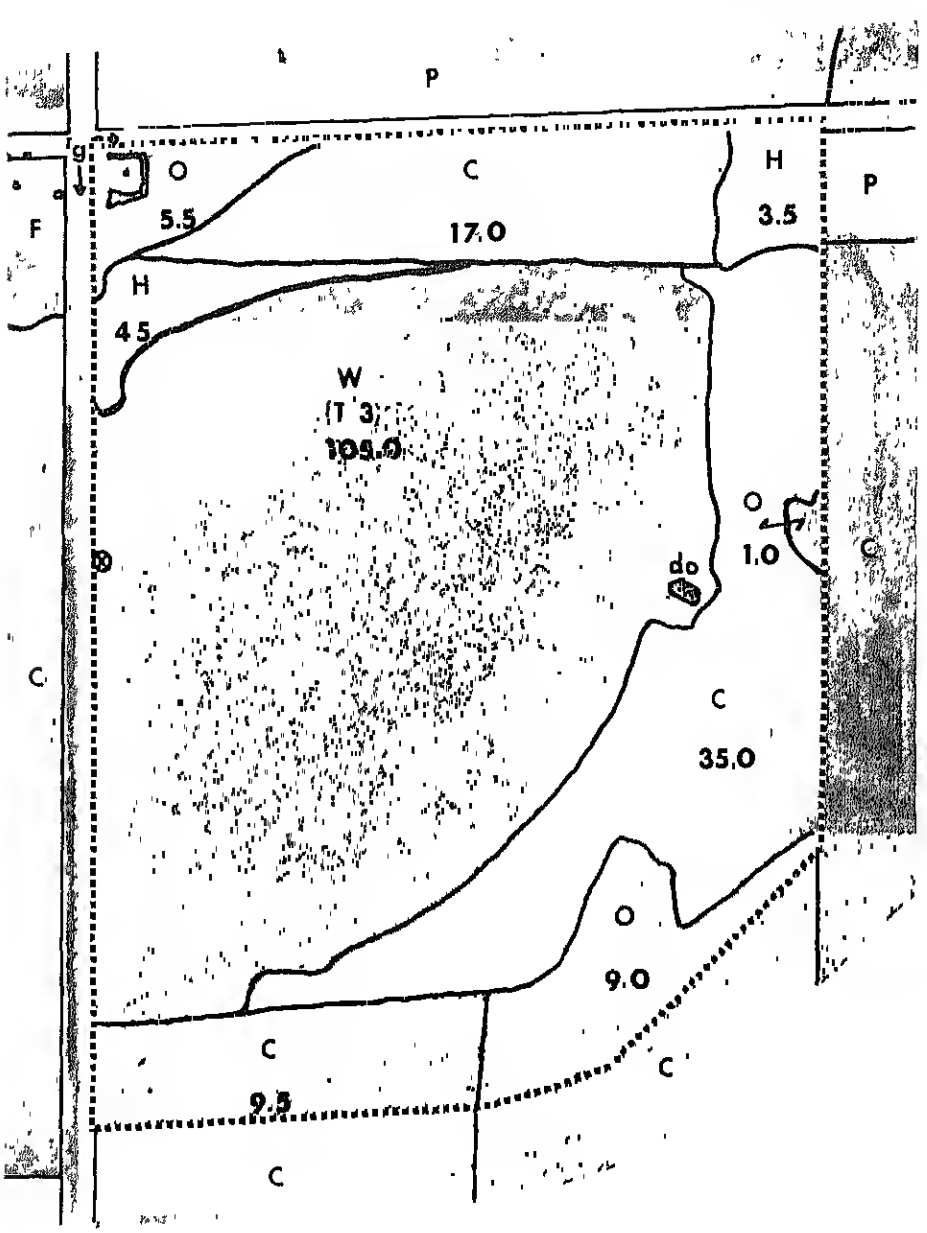
Appendix D-9. "CL-5" WBP Study Site (1977 WBP Agreement). T. 116 N, R. 56 W, Sec. 6 (parts of NW¼ and SW¼) and T 116 N., R. 57 W, Sec. 1(part of SE¼)



Treatments: In May 1977, approximately 44.0 acres of rangeland converted to non-range cover by interseeding alfalfa at 3#/acre. This involved portions of the 30.0 acre N-L, 29.0 acre N-T-L, and 8.0 acre T-N-L fields.

Emergency Haying: Approximately 13% of area (all upland) hayed in second week of August, 1981. Haying occurred on 29.0 acre N-T-L field, and also involved portions of 30.0 acre N-L and 8.0 acre T-N-L fields.

Appendix D-10. "CL-5-C" non-WBP Study Site. T. 116 N, R. 57 W, Sec. 14 (all NW¼ and part SW¼).

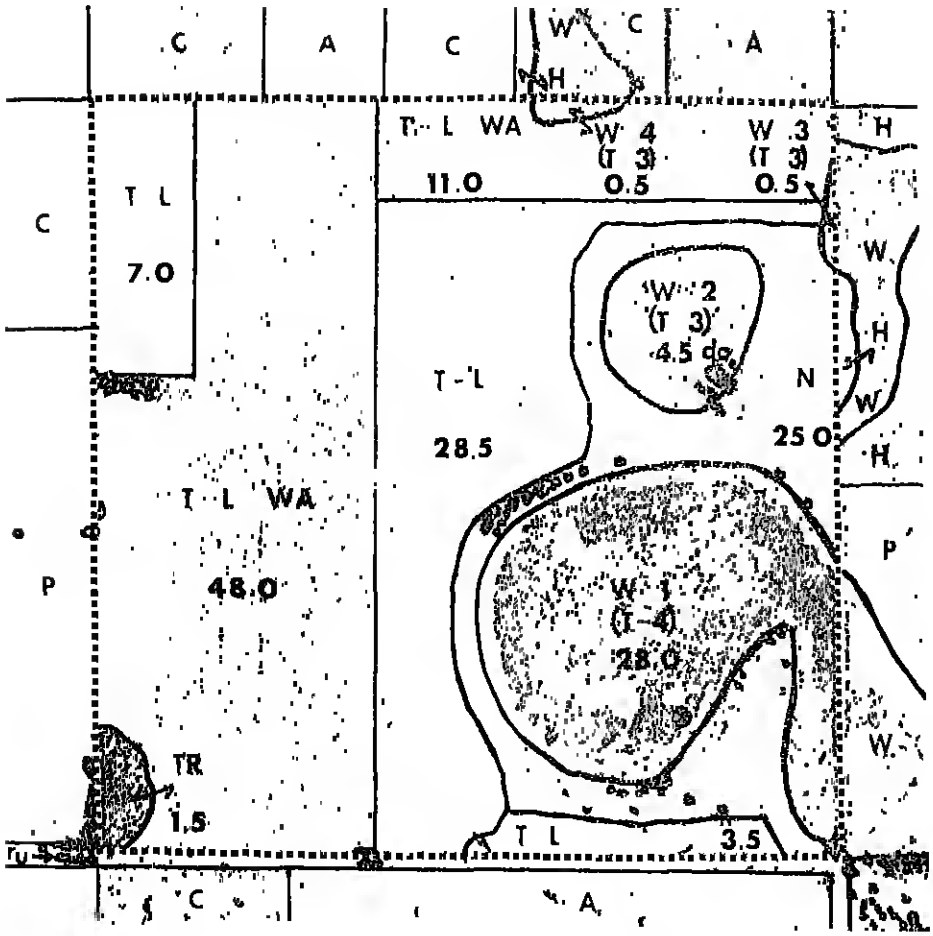


Land Uses on Study Site (percent of area; number of occurrences): Wetland (55%, 1); Cropland (33%, 3); Other (8%, 3); Hay (4%, 2).

Land Use Adjacent to Study Site Perimeter (percent of perimeter in land use; number of occurrences): Perimeter length - 2.2 miles; Cropland (69%, 4); Pasture (26%, 2); Farm (5%, 2).

Comments: The wetland was not used until 1981 when it was hayed.

Appendix D-11. "CL-3" WBP Study Site (1977 WBP Agreement). T. 118 N, R. 58 W, Sec. 17 (SE¼)



Scale - 8" = 1 mi.

N

Total Area 158 acres

21% Wetland
79% Upland

Cover Types on Study Site (percent of area; number of occurrences): Tame-legume-weedy annual (37%, 2); Tame-legume (25%, 3); Wetland (21%, 4); Native (16%, 1); Tree (1%, 1).

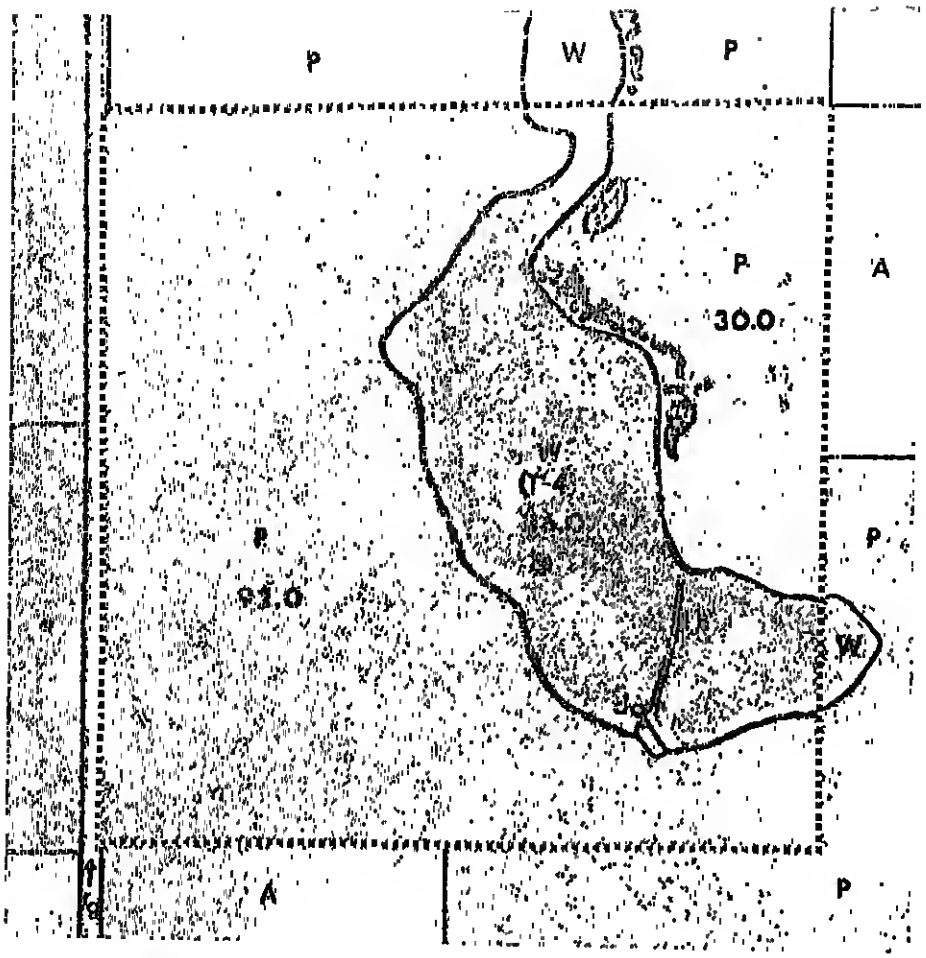
Land Use Adjacent to Study Site Perimeter (percent of perimeter in land use; number of occurrences): Perimeter length - 2.0 miles; Alfalfa (29%, 3); Cropland (25%, 5); Pasture (21%, 2); Wetland (18%, 4); Hay (7%, 4).

Treatments: In April 1977, a mixture of alfalfa (3#/acre) and intermediate wheatgrass (4#/acre) seeded into existing cropland. Involved 11.0 acre T-L-WA and 48.0 acre T-L-WA fields. Interseeded alfalfa into tame grasses at 6½#/acre on the 3.5 acre T-L and 28.5 acre T-L fields.

Emergency Haying: Approximately 88 percent of area hayed between June 19 and October 3, 1981 (117 acres of uplands and 23 acres of wetland). All uplands mowed except areas where trees occurred and a small portion around dugout. Half of wetland #1 and all of the remaining 3 wetlands were mowed.

Appendix D-12. "CL-3-C" non-WBP Study Site. T. 118 N, R. 58 W, Sec. 15 (SW¼).

Scale - 8" = 1 mi.



N

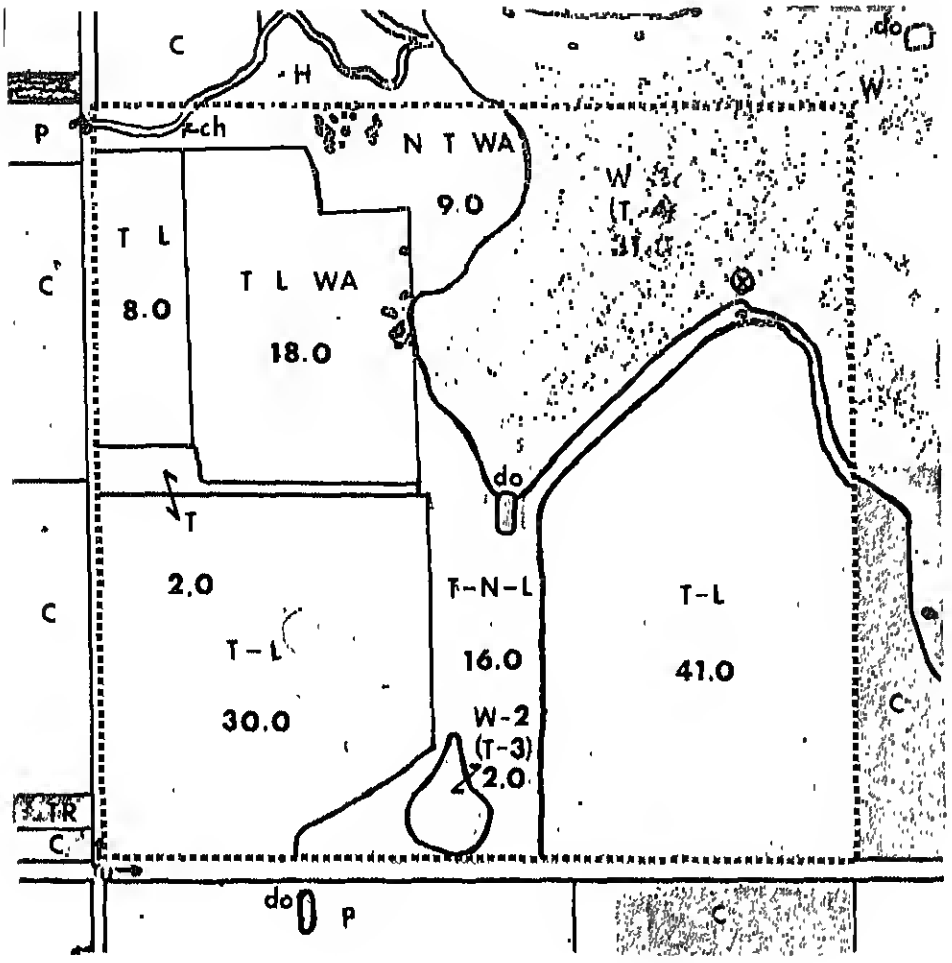
Total Area 158 acres

23% Wetland
77% Upland

Land Uses on Study Site (percent of area; number of occurrences): Pasture (77%, 2); Wetland (23%, 1).

Land Use Adjacent to Study Site Perimeter (percent of perimeter in land use; number of occurrences): Perimeter length - 2.0 miles; Pasture (59%, 5); Alfalfa (24%, 2); Cropland (10%, 1); Wetland (7%, 2).

Appendix D-13. "CL-2" WBP Study Site (1977 WBP Agreement). T. 113 N, R. 56 W, Sec. 7 (SW¼)



Scale - 8" = 1 mi.

N

Total Area 157 acres

21% Wetland
79% Upland

Cover Types on Study Site (percent of area; number of occurrences): Tame-legume (50%, 3); Wetland (21%, 2); Tame-legume-weedy annual (12%, 1); Tame-native-legume (10%, 1); Tame-native-weedy annual (6%, 1); Tree (1%, 1).

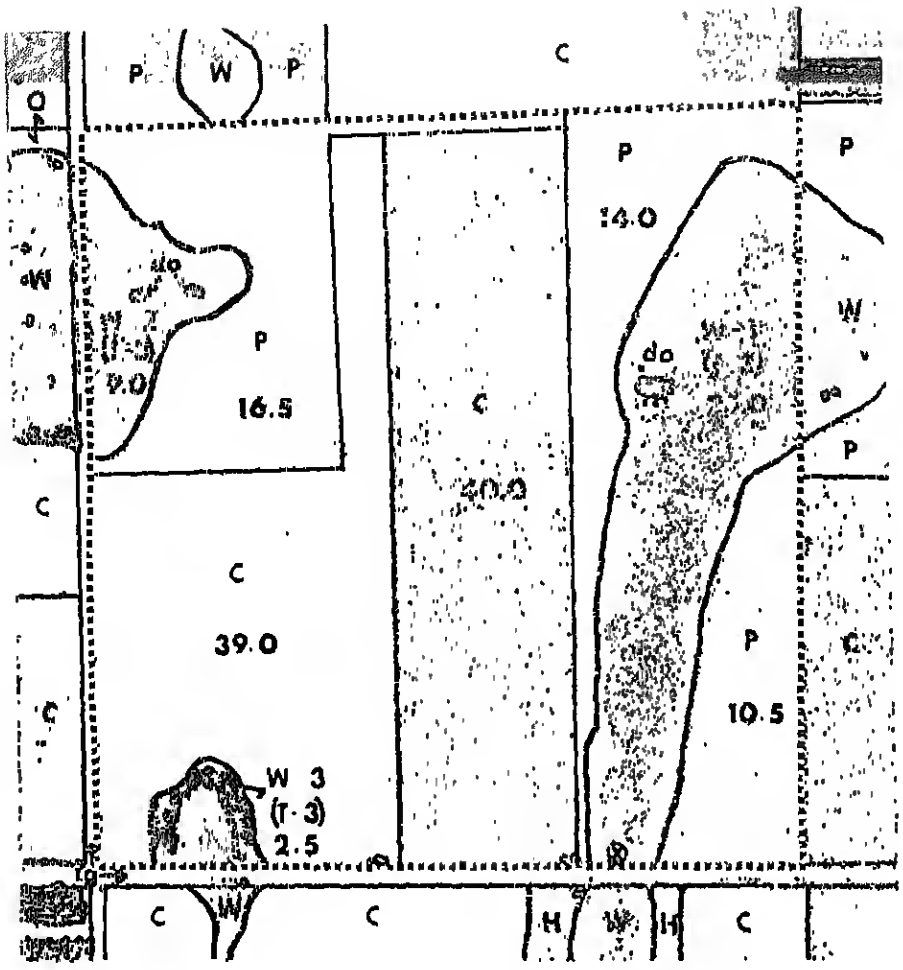
Land Use Adjacent to Study Site Perimeter (percent of perimeter in land use; number of occurrences): Perimeter length - 2.0 miles; Cropland (49%, 6); Wetland (24%, 1); Pasture (18%, 2); Hay (8%, 1); Tree (1%, 1).

Treatments: In spring of 1977, mixture of alfalfa (3#/acre) and intermediate wheatgrass (4#/acre) seeded into existing cropland on the 8.0 acre T-L, 30.0 acre T-L, and 41.0 acre T-L fields. Interseeded alfalfa into tame and native grasses at 6½#/acre on 16.0 acres on parts of 9.0 acre N-T-WA and 16.0 acre T-N-L fields.

Emergency Haying: Approximately 59 percent of area hayed between July 31 and October 15, 1980; upland only. All of the 8.0 acre T-L, 30.0 acre T-L, and 41.0 acre T-L fields were mowed, and portions of the 2.0 acre T, 9.0 acre N-T-WA, and 16.0 acre T-N-L fields were mowed.

Appendix D-14. "CL-2-C" non-WBP Study Site. T. 113 N, R. 57 W, Sec. 11 (SW¼).

Scale - 8" = 1 mi.



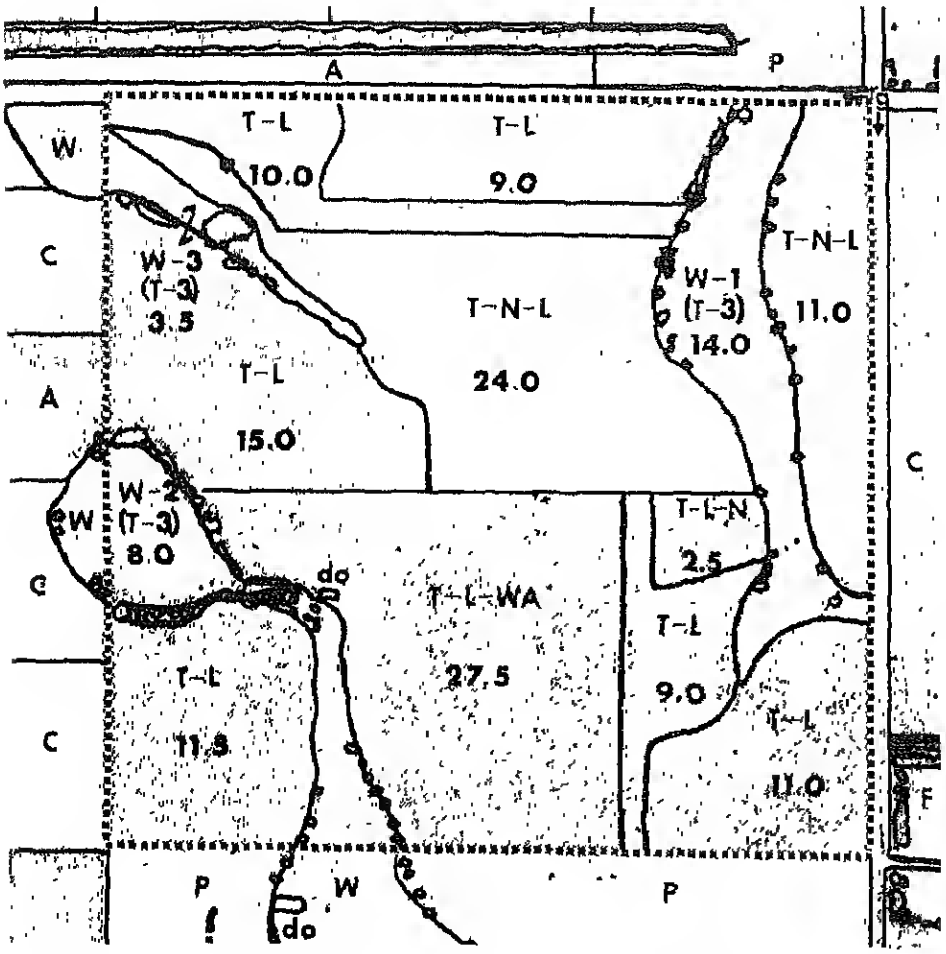
Total Area 157 acres

24% Wetland
76% Upland

Cover Types on Study Site (percent of area; number of occurrences):
Cropland (50%, 2); Pasture (26%, 3); Wetland (24%, 3).

Land Use Adjacent to Study Site Perimeter (percent of perimeter in land use; number of occurrences): Perimeter length - 2.0 miles; Cropland (61%, 7); Wetland (23%, 5); Pasture (12%, 4); Hay (3%, 2); Other (1%, 1).

Appendix D-15. "CL-1" WBP Study Site (1977 WBP Agreement). T. 113 N, R. 56 W, Sec. 31 (NE¼)



Scale - 8" = 1 mi.

N

Total Area 156 acres

16% Wetland
84% Upland

Cover Types on Study Site (percent of area; number of occurrences): Tame-legume (42%, 6); Tame-native-legume (24%, 3); Tame-legume-weedy annual (18%, 1); Wetland (16%, 3).

Land Use Adjacent to Study Site Perimeter (percent of perimeter in land uae; number of occurrences): Perimeter length - 2.0 milea; Cropland (33%, 4); Pasture (31%, 3); Alfalfa (19%, 2); Wetland (13%, 3); Farm (4%, 1).

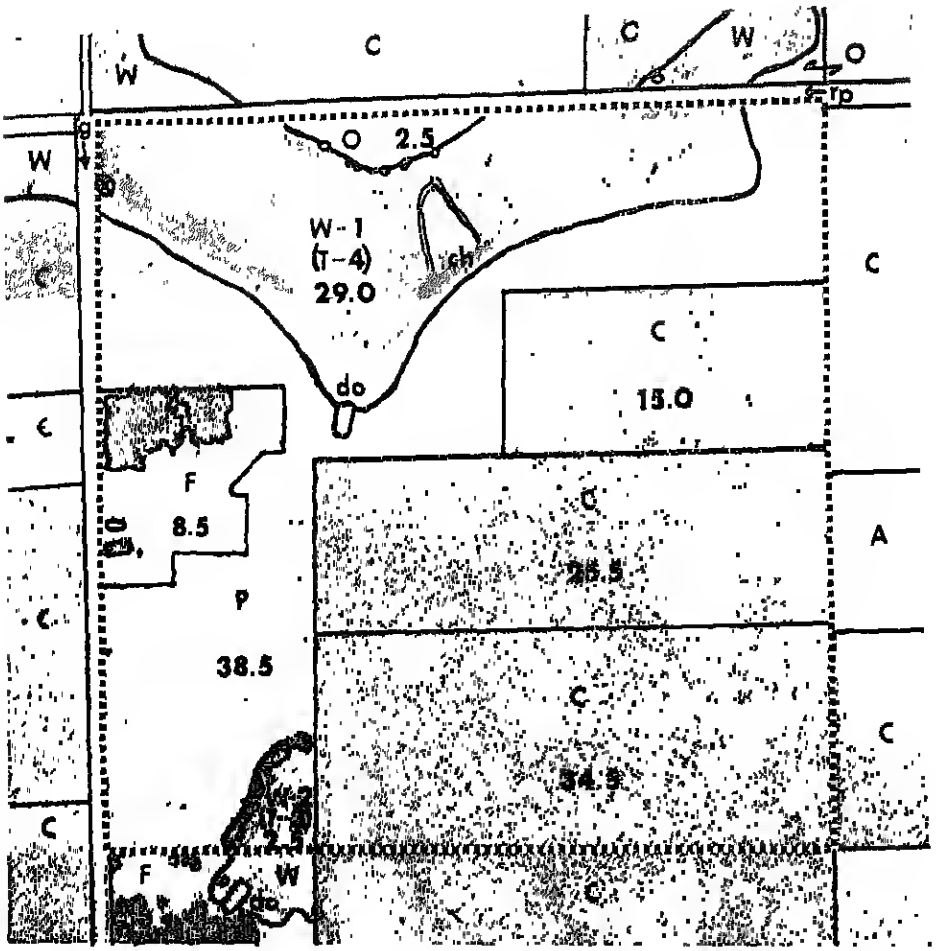
Treatments: In spring of 1977, approximately 54.0 acres reseeded to alfalfa. Seeded 8#/acre with partial seedbed prepared on 10.0 acre T-L and 9.0 acre T-L fields. Interseeded at 6#/acre on the 11.0 acre N-T-L and 24.0 acre T-N-L fields.

Emergency Haying: About 69 percent of area hayad between July 30 and October 20, 1980; uplands only. Portions of all upland fields were hayed. About 33% of area was hayed between July 13 and October 4, 1981 (16 acres wetland and 36 acres upland). All of wetland #1, the southern extenaion of wetland #2, and the narrow eastern part of wetland #3 were cut. Uplands involved all of 11.5 acre T-L field, and a small portion of the remaining fields.

Notes: This area was under the Cropland Adjustmant Program (CAP) from 1967 to 1976, before entering the WBP in 1977.

Appendix D-16. "CL-1-C" non-WBP Study Site. T. 113 N, R. 56 W, Sec. 19 (NW¼).

Scale - 8" = 1 mi.



Total Area 156 acres

20% Wetland
80% Upland

Cover Types on Study Site (percent of area; number of occurrences): Cropland (48%, 3); Pasture (25%, 2); Wetland (20%, 2); Farm (5%, 2); Other (2%, 2).

Land Use Adjacent to Study Site Perimeter (percent of perimeter in land use; number of occurrences): Perimeter length - 2.0 miles; Cropland (73%, 9); Wetland (15%, 4); Alfalfa (5%, 1); Farm (4%, 2); Other (3%, 1).

Appendix D-17. "C-2" WBP Study Site (1978 WBP Agreement). T. 118 N, R. 54 W, Sec. 27 (part SW¼) and Sec. 34 (part NW¼ and NE¼)

Total Area 166 acres

Scale - 8" = 1 mi.

14% Wetland
86% Upland

N

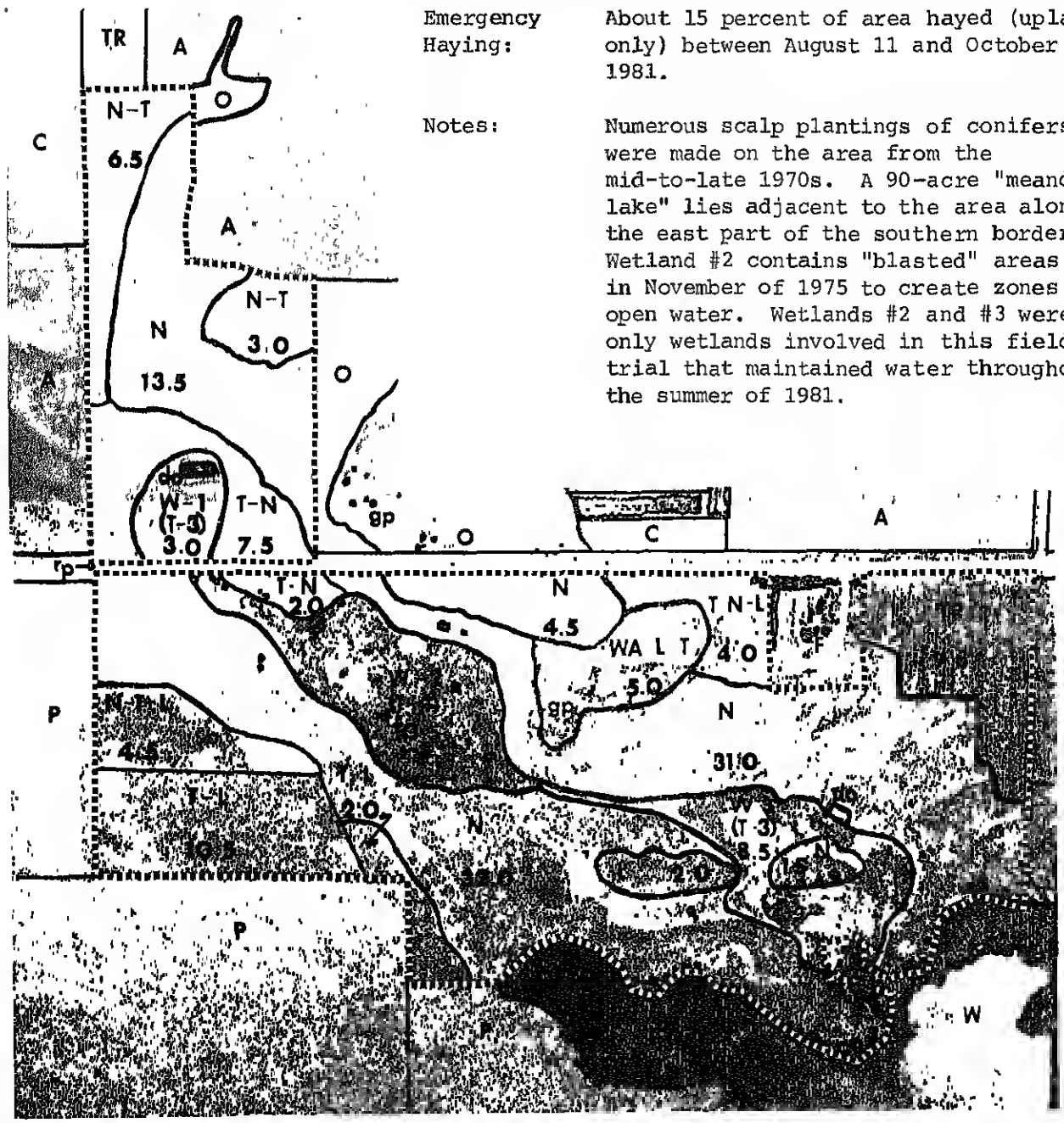
Cover Types on Study Site (percent of area; number of occurrences): Native (52%, 5); Wetland (14%, 3); Tame-native (11%, 4); Tame-legume (8%, 2); Tree (6%, 1); Tame-native-legume (5%, 2); Tame-legume-weedy annual (3%, 1); Legume (1%, 1).

Land Use Adjacent to Study Site Perimeter (percent of perimeter in land use; number of occurrences): Perimeter length - 3.6 miles; Wetland (22%, 1); Alfalfa (19%, 4); Other (18%, 4); Pasture (18%, 3); Cropland (15%, 4); Farm (7%, 1); Tree (1%, 1).

Treatments: In April 1978, straight alfalfa seeded into rangeland, involved the 2.0 acre L field. Mixture of alfalfa and intermediate wheatgrass seeded into cropland on the 4.5 acre N-T-L and 10.5 acre T-L fields.

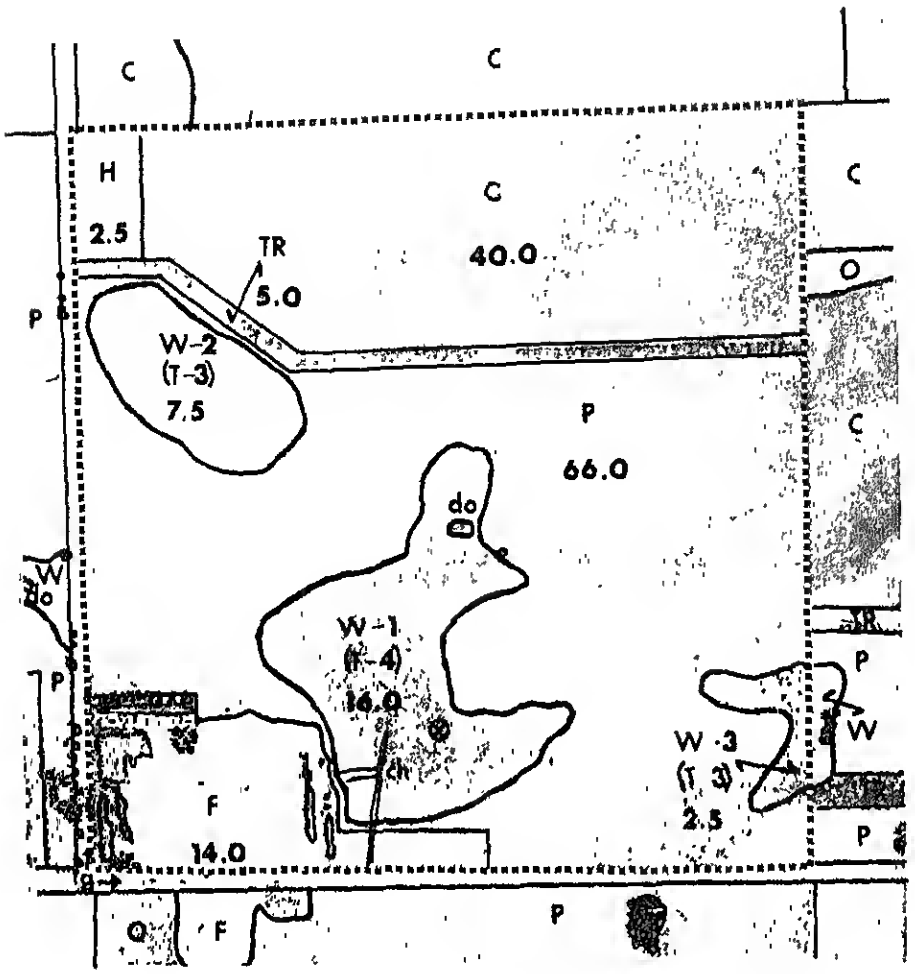
Emergency Haying: About 15 percent of area hayed (uplands only) between August 11 and October 4, 1981.

Notes: Numerous scalp plantings of conifers were made on the area from the mid-to-late 1970s. A 90-acre "meandered lake" lies adjacent to the area along the east part of the southern border. Wetland #2 contains "blasted" areas done in November of 1975 to create zones of open water. Wetlands #2 and #3 were the only wetlands involved in this field trial that maintained water throughout the summer of 1981.



Appendix D-18. "C-2-C" non-WBP Study Site. T. 117 N, R. 54 W, Sec. 17 ($SW\frac{1}{4}$).

Scale - 8" = 1 mi.



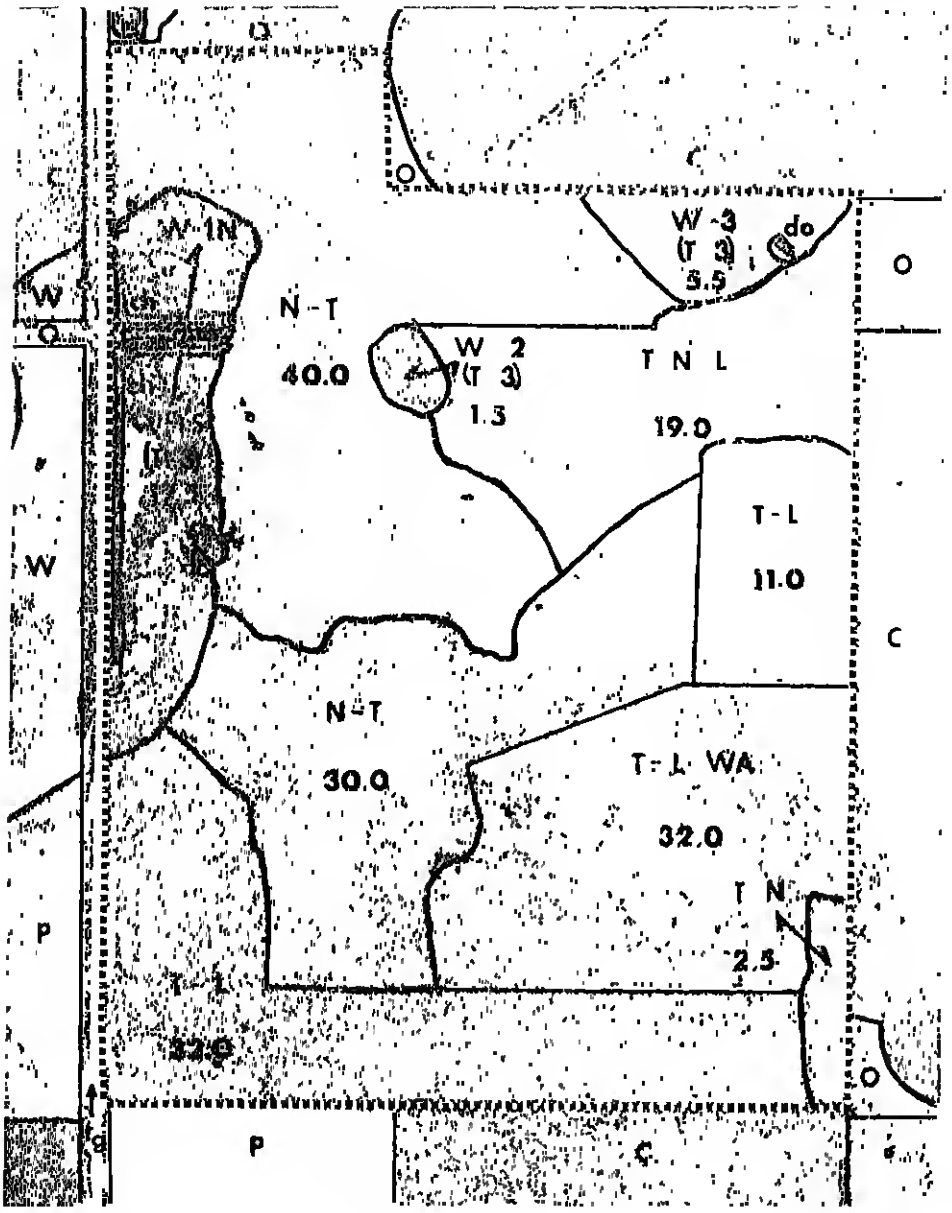
Total Area 157 acres

17% Wetland
83% Upland

Cover Types on Study Site (percent of area; number of occurrences): Pasture (44%, 1); Cropland (25%, 2); Wetland (17%, 3); Farm (9%, 1); Tree (3%, 1); Hay (2%, 2).

Land Use Adjacent to Study Site Perimeter (percent of perimeter in land use; number of occurrences): Perimeter length - 2.0 miles; Pasture (42%, 5); Cropland (40%, 4); Wetland (7%, 2); Farm (5%, 2); Other (4%, 2); Tree (2%, 2).

Appendix D-19. "C-1-(R)" WBP Study Site (1978 WBP Agreement). T. 119 N, R. 56 W, Sec. 28 (part SW¼) and Sec. 33 (NW¼)



Scale - 8" = 1 mi.

N

Total Area 191 acres

13% Wetland
87% Upland

Cover Types on Study Site (percent of area; number of occurrences): Tame-native (38%, 3); Tame-legume (22%, 2); Tame-legume-weedy annual (17%, 1); Wetland (13%, 3); Tame-native-legume (10%, 1).

Land Use Adjacent to Study Site Perimeter (percent of perimeter in land use; number of occurrences): Cropland (49%, 4); Pasture (19%, 2); Other (18%, 5); Wetland (14%, 2).

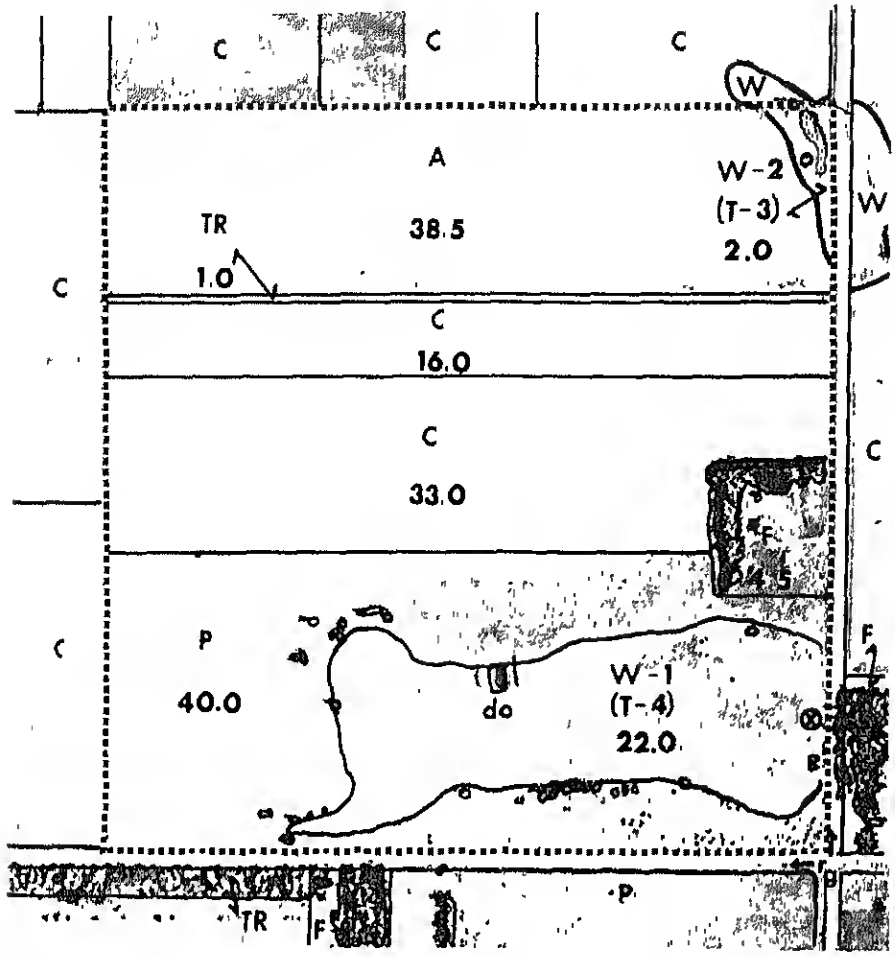
Treatments: In spring of 1978, mixture of alfalfa (3#/acre) and intermediate wheatgrass (5#/acre) aeeded into cropland on 32.0 acre T-L-WA field. Alfalfa (6.5#/acre) interseeded into tame and native grasses on the 11.0 acre T-L and 19.0 acre T-N-L fields.

Emergency Haying: About 44 percent of area hayed during the second week of August 1981. 82 acres of upland and all of wetland #2 was mowed. All of the 32.0 acre T-L ficld and portions of the 2.5 acre T-N, 19.0 acre T-N-L, 30.0 acre N-T, and 40.0 acre N-T fields were mowed.

Notea: The "C-1-(R)" area replaced the "C-1" WBP atudy area in the spring of 1979. In 1978, all counts made on the "C-1" area and in 1979, 2 of the 9 counts were conducted on "C-1"; all remaining counts through 1981 were made on "C-1-(R)". The wildlife count data were combined from both areas for the analysis of data. The "C-1" area comprised 185 acrea, and consisted of 25 percent wetlands (a 41.0 acre Type-4 and 5.5 acre Type-3 wetland) and 75 percent uplands.

Appendix D-20. "C-1-C" non-WBP Study Site. T. 119 N, R. 55 W, Sec. 16 (SE¼).

Scale - 8" = 1 mi.



N

Total Area 157 acres

15% Wetland
85% Upland

Cover Types on Study Site (percent of area; number of occurrences): Cropland (31%, 2); Pasture (25%, 1); Alfalfa (25%, 1); Wetland (15%, 2); Farm (3%, 1); Tree (1%, 1).

Land Use Adjacent to Study Site Perimeter (percent of perimeter in land use; number of occurrences): Perimeter length - 2.0 miles; Cropland (59%, 6); Pasture (15%, 1); Wetland (9%, 2); Farm (9%, 2); Tree (8%, 1).

Appendix E. Summary of count activities conducted on 10 WBP and 10 non-WBP study sites, 1978-1981.

1978
3 - duck breeding pair counts/April 26-June 13/(0700-1830 hours)
2 - duck brood counts/June 14-July 27/(0755-1950 hours)
1 - pheasant brood count/August 1-17/(0705-1455 hours)

6 visits per site
Total time spent on sites: 161.0 hours on WBP/125.7 hours on non-WBP

1979
3 - duck breeding pair counts/April 18-July 3/(0750-1845 hours)
2 - duck brood counts/July 11-August 1/(0940-1945 hours)
*only a single count made on one of the WBP sites
2 - pheasant rooster crowing counts/April 18-June 14/(0600-0925 hours)
1 - pheasant brood count/August 9-28/(0805-1730 hours)
1 - fall pheasant count/October 10-19/(0735-1805 hours)

9 visits per site, except only 8 counts on one WBP site
Total time spent on sites: 138.9 hours on WBP/124.4 hours on non-WBP

1980
3 - duck breeding pair counts/April 14-June 20/(0755-1710 hours)
2 - duck brood counts/June 23-August 7/(0715-1545 hours)
1 - fall pheasant count/October 2-17/(0730-1620 hours)

6 visits per site
Total time spent on sites: 119.7 hours on WBP/79.9 hours on non-WBP

1981
1 - spring (duck breeding pair) count/April 13-29/(0850-1700 hours)
1 - fall (fall pheasant) count/October 3-11/(0720-1810 hours)

2 visits per site
Total time spent on sites: 41.7 hours on WBP/29.9 hours on non-WBP

1978-1981
10 - duck pair counts
6 - duck brood counts
2 - pheasant brood counts
2 - pheasant crowing counts
3 - fall pheasant counts

23 visits per site, except only 22 visits on one WBP site.[a]
Total time spent on sites: 461.3 hours on WBP/359.9 hours on non-WBP.
Average 2.0 hours per visit on WBP/average 1.6 hours per visit on non-WBP.

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[a] Only 452 visits were used for data on other wildlife species instead of 459, because during 1979 on 7 study sites the duck breeding pair count and the pheasant rooster crowing count were conducted back to back during the same visit. The two counts were considered as a single visit and the time taken to do both counts was used in calculating the number of other wildlife species observed per hour as well as the frequency of occurrence.

Appendix F. Numbers of indicated breeding pairs and duck broods observed at each study site in each year of the study.

Study Sites	Indicated Breeding Pairs 1978	1979	1980	1981	Total	Duck Broods 1978	1979	1980	Total
WBP									
K-6	157	19	10	2	188	4	2	1	7
K-4	109	15	4	3	131	14	-	-	14
K-3	107	166	3	-	276	9	3	-	12
K-2	166	41	4	-	211	38	3	-	41
CL-5	205	79	13	1	298	18	-	-	18
CL-3	105	105	98	2	310	15	9	3	27
C1-2	103	55	21	1	180	6	6	-	12
CL-1	147	36	1	-	184	7	-	-	7
C-2	78	117	47	14	256	5	13	3	21
C-1/C-1-(R)[a]	160	64[b]	32	3	259	6	8	3	17
Subtotal WBP sites	1337	697	233	26	2293	122	44	10	176
non WBP									
K-6-C	72	20	3	6	101	10	-	-	10
K-4-C	158	55	10	6	229	18	2	-	20
K-3-C	75	32	4	7	118	5	2	-	7
K-2-C	64	15	-	1	80	5	1	-	6
CL-5-C	210	45	7	1	263	10	-	-	10
CL-3-C	86	75	34	1	196	10	1	-	11
CL-2-C	121	70	19	1	211	17	8	2	27
CL-1-C	129	99	74	2	304	14	31	-	45
C-2-C	116	118	71	3	308	19	1	1	21
C-1-C	76	104	123	1	304	10	6	9	25
Subtotal non-WBP	1107	633	345	29	2114	118	52	12	182
Totals	2444	1330	578	55	4407	240	96	22	358

[a] The C-1 site was taken out of WBP in 1979 and was replaced by site C-1-(R) in the same year.

[b] In 1979, the first breeding pair count was conducted on the C-1 WBP site. The second and third counts were done on the C-1-(R) replacement site. The three counts were totaled for the 1979 number of indicated breeding pairs.

Appendix G. Ground and over-water nests located during count activities conducted on 10 WBP and 10 non-WBP study sites, 1978-1980.

Species	Number on 10 WBP Sites (% of nests for species)	Number on 10 non-WBP Sites (% of nests for species)
Blue-winged teal	16 (55%)	13 (45%)
Mallard	16 (76%)	5 (24%)
Common pintail	2 (67%)	1 (33%)
Northern shoveler	1 (50%)	1 (50%)
Gadwall	1 (100%)	0 (0%)
Green-winged teal	0 (0%)	1 (100%)
All Dabblers	36 (63%)	21 (37%)
Redhead	26 (62%)	16 (38%)
Canvasback	3 (50%)	3 (50%)
Ruddy duck	3 (60%)	2 (40%)
All Divers	32 (60%)	21 (40%)
All Ducks	68 (62%)	42 (38%)
American coot	133 (29%)	332 (71%)
Ring-necked pheasant	9 (100%)	0 (0%)
Northern harrier	10 (77%)	3 (23%)

Appendix H. Species list of birds and mammals observed on the study sites during 1978 through 1981. The numbers presented represent the relative frequency of observation (as a percentage value) of these species on the respective WBP and non-WBP study sites.

BIRDS	WBP (N=266)[b]	non-WBP (N=266)
Eared grebe (Podiceps nigricollis)	0.8	0.4
Pied-billed grebe (Podilymbus podiceps)	5.3	8.0
American white pelicsn (Pelecanus erythrorhynchos)	0.8	0.0
Double-crested cormorsnt (Phalacrocorax auritus)	2.6	0.8
Great blue heron (Ardea herodias)	3.5	3.0
Green heron (Butorides striatus)	0.4	0.0
Cattle egret (Bubulcus ibis)	0.0	0.8
Grest egret (Cssmerodius slbus)	0.0	0.4
Blsck-crowned night heron (Nycticorax nycticorax)	6.6	8.0
Least bittern (Ixobrychus exilis)	0.4	0.0
American bittern (Botaurus lentiginosus)	17.6	12.8
Canada goose (Branta canadensis)	*[c]	0.0
Snow goose (Chen caerulescens)	0.4	0.0
Sharp-shinned hswk (Accipiter striatus)	0.8	0.0
Cooper's hawk (A. cooperii)	0.0	0.4
Red-tailed hawk (Buteo jamaicensis)	13.7	13.7

Appendix H. (continued)

BIRDS	WBP (N=266)[b]	non-WBP (N=266)
Swainson's hawk (*B. swainsoni*)	8.0	7.5
Northern harrier (*Circus cyaneus*)	52.2	28.8
Prairie falcon (*Falco mexicanus*)	0.4	0.4
American kestrel (*F. sparverius*)	2.2	1.8
Gray partridge (*Perdix perdix*)	4.4	7.5
King rail (*Rallus elegans*)	0.0	0.8
Virginia rail (*R. limicola*)	9.7	8.4
Sora (*Porzana carolina*)	11.9	9.2
Yellow rail (*Coturnicops noveboracensis*)	1.3	0.0
American avocet (*Recurvirostra americana*)	0.0	0.4
Killdeer (*Charadrius vociferus*)	39.4	64.2
Marbled godwit (*Limosa fedoa*)	0.0	0.4
Upland sandpiper (*Bartramina longicauda*)	6.2	10.2
Greater yellowlegs (*Tringa melanoleuca*)	0.4	0.0
Lesser yellowlegs (*T. flavipes*)	0.8	0.8
Solitary sandpiper (*T. solitaria*)	0.4	0.0
Willet (*Catoptrophorus semipalmatus*)	4.8	1.8

Appendix H. (continued)

BIRDS	WBP (N=266) [b]	non-WBP (N=266)
Spotted sandpiper (Actitis macularia)	0.0	1.8
Wilson's phalarope (Steganopus tricolor)	4.0	0.8
Common snipe (Capella gallinago)	2.2	7.5
Long-billed dowitcher (Limnodromus scolopaceus)	0.0	0.8
White-rumped sandpiper (Calidris fuscicollis)	0.4	4.4
Herring gull (Larus argentatus)	0.0	0.8
Ring-billed gull (Larus delawarensis)	2.2	3.0
Franklin's gull (L. pipixcan)	30.0	22.6
Forster's tern (Sterna forsteri)	0.8	0.0
Common tern (S. hirundo)	1.3	1.8
Caspian tern (S. caspica)	0.0	0.4
Black tern (Chlidonias niger)	22.6	27.0
Rock dove (Columba livia)	8.8	15.0
Mourning dove (Zenaida macroura)	73.0	74.3
Yellow-billed cuckoo (Coccyzus americanus)	0.4	0.4
Black-billed cuckoo (C. erythrophthalmus)	5.8	3.0
Great horned owl (Bubo virginianus)	21.6	11.9

Appendix H. (continued)

BIRDS	WBP (N=266)[b]	non-WBP (N=266)
Short-eared owl (Asio flammeus)	4.0	1.3
Common nighthawk (Chordeiles minor)	0.4	0.0
Chimney swift (Chaetura pelagica)	*[c]	0.0
Belted kingfisher (Megaceryle alcyon)	0.4	0.4
Common flicker[d] (Colaptes auratus)	27.4	24.8
Red-headed woodpecker (Melanerpes erythrocephalus)	2.6	7.5
Hairy woodpecker (Picoides villosus)	6.2	0.8
Downy woodpecker (P. pubescens)	4.8	4.8
Eastern kingbird (Tyrannus tyrannus)	49.6	47.3
Weatern kingbird (T. verticalis)	29.2	27.0
Eastern phoebe (Sayornis phoebe)	1.3	0.0
Least flycatcher[e] (Empidonax minimus)	2.6	1.3
Horned lark (Eremophila alpestris)	5.3	18.1
Tree swallow (Iridoprocne bicolor)	23.4	10.2
Bank swallow (Riparia riparia)	23.8	15.9
Rough-winged swallow (Stelgidopteryx ruficollis)	4.4	3.5
Barn swallow (Hirundo rustica)	72.1	

Appendix H. (continued)

BIRDS	WBP (N=266)[b]	non-WBP (N=266)
Cliff swallow (Petrochelidon pyrrhonota)	2.2	1.3
Purple martin (Progne subis)	1.3	0.0
Blue jay (Cyanocitta cristata)	5.8	7.0
American crow (Corvus brachyrhynchos)	7.5	4.8
Black-capped chickadee (Parus atricapillus)	2.2	0.4
White-breasted nuthatch (Sitta carolinensis)	0.4	0.0
Brown creeper (Certhia familiaris)	0.4	0.0
House wren (Troglodytes aedon)	6.2	4.8
Marsh wren (Cistothorus palustris)	37.6	25.2
Sedge wren (C. platensis)	7.0	2.2
Gray catbird (Dumetella carolinensis)	0.0	0.8
Brown thrasher (Toxostoma rufum)	8.4	7.5
American robin (Turdus migratorius)	25.6	31.8
Wood thrush (Hylocichla mustelina)	0.4	0.0
Hermit thrush (Catharus guttatus)	0.4	0.0
Eastern bluebird (Sialia sialis)	0.0	0.4
Ruby-crowned kinglet (Regulus calendula)	0.4	0.0

Appendix H. (continued)

BIRDS	WBP (N=266)[b]	non-WBP (N=266)
Loggerhead shrike (Lanius ludovicianus)	0.4	0
European starling (Sturnus vulgaris)	10.2	13.2
Black-and-white warbler (Mniotilta varia)	0.0	0.4
Yellow warbler (Dendroica petechia)	4.4	4.0
Magnolia warbler (D. magnolia)	0.0	0.8
Yellow-rumped warbler (D. coronata)	3.0	1.8
Blackpoll warbler (D. striata)	0.4	0.0
Common yellowthroat (Geothlypis trichas)	35.4	19.9
Yellow-breasted chat (Icteria virens)	0.0	0.4
House sparrow (Passer domesticus)	4.0	11.5
Bobolink (Dolichonyx oryzivorus)	36.2	12.8
Western meadowlark (Sturnella neglecta)	68.1	66.4
Yellow-headed blackbird (Xanthocephalus xanthocephalus)	61.0	60.2
Red-winged blackbird (Agelaius phoeniceus)	81.0	83.2
Orchard oriole (Icterus spurius)	7.5	3.0
Northern oriole (I. galbula)	0.8	2.2
Brewer's blackbird (Euphagus cyanocephalus)	0.4	0.0

Appendix H. (continued)

BIRDS	WBP (N=266)[b]	non-WBP (N=266)
Common grackle (Quiscalus quiscula)	62.4	65.0
Brown-headed cowbird (Molothrus ater)	46.9	42.0
Dickcissel (Spiza americana)	35.0	12.8
Purple finch (Carpodacus purpureus)	0.4	0.8
American goldfinch (Carduelis tristis)	18.6	11.0
Lark bunting (Calamospiza melanocorys)	2.2	3.0
Savannah sparrow (Passerculus sandwichensis)	0.4	0.0
Grasshopper sparrow (Ammodramus savannarum)	9.2	3.5
Sharp-tailed sparrow (A. caudacuta)	0.4	0.0
Vesper sparrow (Pooecetes gramineus)	4.0	11.5
Northern junco (Junco hyemalis)	4.4	4.0
American tree sparrow (Spizella arborea)	2.2	1.8
Chipping sparrow (S. passerina)	0.4	0.4
Clay-colored sparrow (S. pallida)	11.9	0.4
Field sparrow (S. pusilla)	3.0	0.0
Harris' sparrow (Zonotrichia querula)	3.0	3.5
White-crowned sparrow (Z. leucophrys)	1.8	0.4

Appendix H. (continued)

BIRDS	WBP (N=266)[b]	non-WBP (N=266)
White-throated sparrow (Z. albicollis)	0.0	0.4
Swamp sparrow (Melospiza georgiana)	4.4	1.8
Song sparrow (M. melodia)	38.9	19.5
Chestnut-collared longspur (Calcarius ornatus)	2.6	9.7
(TOTAL NUMBER OF OTHER BIRD SPECIES)	(106)	(97)

	WBP (N=229)[b]	non-WBP (N=230)
Ring-necked pheasant (Phasianus colchicus)	52.4	31.3

	WBP (N=100)[b]	non-WBP (N=100)
Mallard (Anas platyrhynchos)	82.0	80.0
Gadwall (A. strepera)	51.0	58.0
Common pintail (A. acuta)	62.0	65.0
Green-winged teal (A. crecca)	30.0	31.0
Blue-winged teal (A. discors)	75.0	78.0
American wigeon (A. americana)	8.0	12.0
Northern shoveler (A. clypeata)	59.0	65.0
Wood duck (Aix sponsa)	3.0	0.0
Redhead (Aythya americana)	46.0	48.0
Ring-necked duck (A. collaris)	5.0	2.0

Appendix H. (continued)

BIRDS	WBP (N=100)[b]	non-WBP (N=100)
Canvasback (A. valisineria)	19.0	12.0
Lesser scaup (A. affinis)	6.0	10.0
Bufflehead (Bucephala albeola)	0.0	1.0
Ruddy duck (Oxyura jamaicensis)	9.0	20.0
(TOTAL NUMBER OF DUCK SPECIES)	(13)	(13)
American coot (Fulica americana)	57.0	55.0

MAMMALS[f]	WBP (N=226)	non-WBP (N=226)
Raccoon (Procyon lotor)	0.8	0.8
Longtail weaael (Mustela frenata)	0.0	0.4
Mink (M. vison)	0.4	0.0
Badger (Taxidea taxus)	0.4	0.4
Striped skunk (Mephitis mephitis)	0.4	0.0
Red fox (Vulpes fulva)	5.3	3.5
Richardaon ground squirrel (Citellus richardsoni)	19.9	35.4

Appendix H. (continued)

MAMMALS	WBP (N=226)[b]	non-WBP (N=226)
Thirteen-lined ground squirrel (C. tridecemlineatus)	4.8	11.5
Franklin ground squirrel (C. franklini)	0.4	1.3
Eastern fox squirrel (Sciurus niger)	2.6	2.6
Muskrat (Ondatra zibethica)	0.0	0.4
Whitetail jackrabbit (Lepus townsendi)	27.0	42.4
Eastern cottontail (Sylvilagus floridanus)	9.3	7.5
Whitetail deer (Odocoileus virginianus)	33.6	11.5
(TOTAL NUMBER OF MAMMAL SPECIES)	(12)	(12)

[a] Common and scientific name according to Peterson and Peterson (1980).

[b] "N" represents the number of visits made to the study sites during which the count data were recorded. For example, over the 4-year period a total of 226 visits were made to the WBP study sites, and the eared grebe was observed on these sites on 0.8% of the visits (or during 2 of 226 visits made).

[c] These species were observed during nest search activities, which were only conducted on the 10 WBP study sites in June through August 1981.

[d] The common flicker was represented by the "yellow-shafted" form, except for a single occurrence of the "red-shafted" form on a WBP study site.

[e] Species of the Empidonax flycatchers are difficult to identify in the field on the basis of visual characteristics only, and correct identification is frequently impossible unless their song is heard, so these data may include species other than E. minimus.

[f] Common and scientific name according to Burt and Grossenheider (1964). (For a listing of small mammal species encountered during snap-trap surveys, consult Appendix I).

Appendix I. Results of small mammal trapping conducted on 10 WBP and 10 non-WBP study sites during June-August 1978 and June-July 1979.

WBP Study Sites	Date Set	Number of Traps Set	Species[a] and Number Caught	non-WBP Study Areas	Date Set	Number of Traps Set	Species[a] and Number Caught
K-6	7-10-78	25	1-HM	K-6-C	7-10-78	25	3-DM/1-HM
	8-1-78	30	1-DM		8-1-78	30	1-DM
	7-2-79	25	None		7-2-79	25	None
K-4	7-11-78	50	10-DM	K-4-C	7-11-78	50	10-DM
	8-2-78	30	1-SS		8-2-78	30	1-DM
	7-2-79	25	3-MV		7-2-79	25	1-DM
K-3	7-13-78	30	6-DM	K-3-C	7-13-78	30	3-DM/1-MV
	6-27-79	25	2-DM		6-27-79	25	1-DM
	7-18-79	25	1-MS		7-18-79	25	4-DM
K-2	8-3-78	30	5-DM/1-MV	K-2-C	8-3-78	30	None
	6-27-79	25	1-DM		6-27-79	25	2-DM/2-NGM
	7-18-79	25	None		7-18-79	25	2-DM
CL-5	6-30-78	50	2-DM	CL-5-C	6-30-78	50	None
	6-21-79	19	4-MV		6-21-79	19	1-DM
	7-11-79	20	2-MV		7-11-79	20	None
	7-23-79	20	None		7-23-79	20	None
CL-3	6-25-79	18	None	CL-3-C	6-25-79	19	1-DM
	7-16-79	20	None		7-16-79	20	1-DM
	7-25-79	20	1-DM		7-25-79	20	1-DM
CL-2	7-18-78	40	1-DM/1-MV/1-WHM	CL-2-C	7-18-78	40	3-DM/2-MV
	6-25-79	25	1-DM/1-MJM		6-25-79	25	1-DM
	7-16-79	20	1-MV		7-16-79	20	1-SS
	7-25-79	20	5-DM/1-MV		7-25-79	20	2-MV/1-DM
CL-1	7-17-78	40	4-DM/2-MV/ 2-NGM	CL-1-C	7-17-78	40	4-DM/1-NGM/ 1-MJM
	8-9-78	30	2-DM		8-9-78	30	1-DM/1-MV
	6-25-79	25	1-MJM/1-SS		6-25-79	25	2-MV/1-DM
	7-16-79	19	1-DM/1-MS		7-16-79	19	None
	7-25-79	19	1-DM		7-25-79	19	2-MV/1-MJM
C-2	8-16-78	30	3-DM	C-2-C	8-16-78	30	3-DM
	6-21-79	25	1-DM		6-21-79	25	None
	7-11-79	20	3-DM		7-11-79	20	1-MV
	7-23-79	20	None		7-23-79	20	2-DM

Appendix I. (continued)

WBP Study Sites	Date Set	Number of Traps Set	Species and Number Caught	non-WBP Study Sites	Date Set	Number of Traps Set	Species and Number Caught
C-1-(R)	6-21-79	25	None	C-1-C	6-21-79	25	None
	7-11-79	20	2-MJM/1-SS		7-11-79	20	5-DM
	7-23-79	20	2-MV		7-23-79	20	None
TOTALS:	1978	385	34DM/4-MV/2-NGM /1-HM/1-SS/1-WHM	TOTALS:	1978	385	29-DM/4-MV /1-NGM /1-HM/1-MJM
(43 individuals caught ÷ 385 traps set for a "catch rate" of 11.2%/6 species)				(36 individuals caught ÷ 385 traps set for a "catch rate" of 9.4%/5 species)			
	1979	525	16-DM/13-MV/ 4-MJM/2-SS/2-MS		1979	526	24-DM/7-MV /2-NGM/1-MJM /1-SS
(37 ÷ 525, for a catch rate of 7.0%/ 5 species)				(35 ÷ 526, for a catch rate of 6.6%/ 5 species)			
	Overall	910	50DM/17-MV/4-MJM /3-SS/2-NGM/2-MS /1-HM/1-WHM		Overall	911	53-DM/11-MV /3-NCM/2-MJM/ 1-HM/1-SS
(80 ÷ 910, for a catch rate of 8.8%/ 8 species)				(71 ÷ 911, for a catch rate of 7.8%/ 6 species)			

[a]Key to species (common and scientific name according to Burt and Grossenheider (1964))

MS = Masked shrew (Sorex cinereus)

SS = Shorttail shrew (Blarina brevicauda)

WHM = Western harvest mouse (Reithrodontomys megalotis)

DM = Deer mouse (Peromyscus maniculatus)

NGM = Northern grasshopper mouse (Onychomys leucogaster)

MV = Meadow vole (Microtus pennsylvanicus)

HM = House mouse (Mus musculus)

MJM = Meadow jumping mouse (Zapus hudsonius)

Appendix J. Summary of count data for selected species of other wildlife observed on 10 WBP and 10 non-WBP study sites, 1978-1981.

Species[a]	Percent on 10 WBP Sites	Percent on 10 non-WBP Sites	Total Number of Individuals Observed
Whitetail deer (adult)	79%	21%	226
Whitetail deer (young)	76%	24%	21
Red fox	65%	35%	17
Whitetail jackrabbit	30%	70%	343
Eastern cottontail	54%	46%	52
Gray partridge	35%	65%	74
Northern harrier	69%	31%	258
Swainson's hawk	51%	49%	43
Red-tailed hawk	47%	53%	77
Great horned owl	65%	35%	97
Short-eared owl	77%	23%	13
Great blue heron	44%	56%	18
Black-crowned night heron	44%	56%	46
American bittern	57%	43%	103

[a] Unless otherwise indicated, the values represent adult individuals.

Appendix K. Summary of wildlife count data collected on the 20 individual study area sites, 1978-1981.

Study[a] Site	Duck Indicated Breeding Pairs	Duck Broods	Adult Coots	Young Coots	Adult Pheasants (Observed Per Hour)		Pheasant Young (Pheasant Broods)		Other Wildlife Birds Per Visit (Per Hour)		Other Wildlife Mammals Per Visit (Per Hour)		Duck Species Observed	Other[b] Bird Species Observed	Mammal[c] Species Observed	Deer Young	Deer Adult
K-6	188	7	82	1	125	(2.5)	22	(3)	11.9	(6.6)	0.7	(0.4)	10	55	4	3	7
K-6-C	101	10	128	2	62	(1.6)	0	(0)	12.6	(8.0)	1.0	(0.8)	9	56	8	0	6
K-4	131	14	26	1	67	(1.8)	8	(1)	17.1	(15.2)	1.3	(0.8)	11	69	8	5	20
K-4-C	229	20	120	11	5	(0.1)	4	(1)	13.6	(10.1)	1.2	(2.7)	10	57	4	0	0
K-3	276	12	50	2	224	(4.2)	47	(8)	15.1	(7.3)	1.5	(0.4)	9	54	7	1	10
K-3-C	118	7	27	1	46	(1.3)	0	(0)	14.0	(10.4)	1.3	(1.0)	8	54	7	1	5
K-2	211	41	43	1	34	(0.9)	16	(1)	11.8	(9.4)	1.2	(0.7)	10	53	6	1	13
K-2-C	80	6	2	0	7	(0.2)	23	(3)	8.8	(10.0)	1.2	(1.4)	7	39	6	0	1
CL-5	298	18	107	8	110	(1.6)	0	(0)	12.8	(4.9)	1.2	(0.5)	10	53	4	0	15
CL-5-C	263	10	38	25	67	(1.2)	7	(2)	9.8	(4.9)	0.8	(0.3)	10	39	5	3	18
CL-3	310	27	418	9	43	(0.8)	0	(0)	16.4	(8.4)	1.3	(0.6)	13	60	6	2	62
CL-3-C	196	11	75	3	2	(0.1)	0	(0)	13.2	(8.0)	1.6	(1.0)	11	49	6	0	11
CL-2	180	12	48	0	117	(2.8)	19	(5)	12.4	(7.3)	0.9	(0.6)	7	53	5	4	21
CL-2-C	211	27	43	2	40	(1.1)	10	(3)	12.8	(9.4)	1.4	(1.0)	9	53	6	1	4
CL-1	184	7	22	0	93	(2.6)	32	(4)	15.7	(11.2)	1.3	(1.2)	8	58	7	0	20
CL-1-C	304	45	279	17	9	(0.2)	4	(1)	12.2	(8.9)	1.6	(1.2)	11	55	5	0	0
C-2	256	21	48	1	146	(3.2)	12	(1)	14.4	(7.7)	1.2	(0.7)	10	57	6	0	1
C-2-C	308	21	196	19	26	(0.6)	7	(1)	14.4	(8.8)	1.4	(1.0)	11	64	7	0	0
C-1 and C-1-(R)	259	17	85	4	23	(0.5)	8	(1)	12.0	(7.1)	0.8	(0.5)	10	43	5	0	10
C-1-C	304	25	156	16	36	(1.2)	8	(2)	12.4	(10.6)	0.5	(0.3)	13	56	6	0	2
10 WBP Sites																	
Total	2293	176	929	27	982	(2.1)	164	(24)					13	106	12	16	179
Average									14.0	(8.5)	1.2	(0.6)	9.8	55.5	5.8		
10 non-WBP Sites																	
Total	2114	182	1064	96	300	(0.8)	63	(13)					13	97	12	5	47
Average									12.4	(8.9)	1.2	(0.8)	9.9	52.2	6.0		
ALL SITES																	
Total	4407	358	1993	123	1282	(1.6)	227	(37)					14	122	14	21	226
Average									13.2	(8.7)	1.2	(0.7)	9.8	53.8	5.9		

[a] The first site listed is the WBP site, the second is its paired non-WBP site.
[b] This includes all bird species other than the ducks, coot, and pheasant.
[c] Small mammal species not included; see Appendix I for snap-trap surveys conducted on the study sites.

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